SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

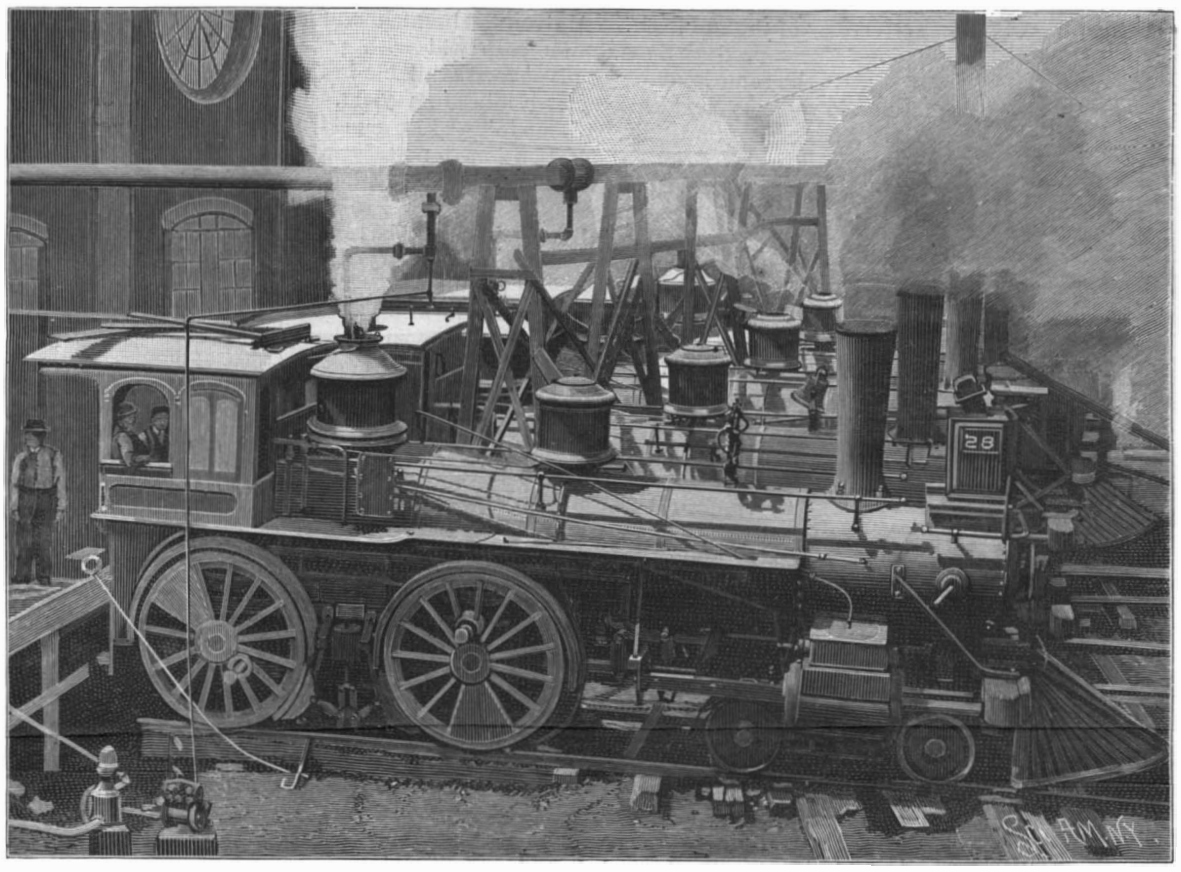
Vol. LXXIII.—No. 1. ESTABLISHED 1845. NEW YORK. JULY 6, 1895 $3.00 A YEAR. WEEKLY.

A STEAM SUPPLY FROM COMBINED LOCOMOTIVES.

Some time ago the Ohio Steel Company, of Youngstown, O., not being able to generate sufficient steam with the boilers already constructed, and not wishing to wait for the completion of those in course of erection, obtained six locomotives from the N. Y., L. E. & W. RR. Co.'s round house, and, placing them side by side at the rear of the engine house, connected them up as shown in our illustrations.

Each locomotive supplies steam to the extent of 100 horse power, the aggregate being 600 horse power.

Our engravings are from photographs specially taken for the SCIENTIFIC AMERICAN by Mr. James J. Dalzell, of Youngstown. In our SUPPLEMENT of this week we give a number of illustrations of the works of the Ohio Steel Company, which, we believe, is now the second largest establishment of the kind in this country.



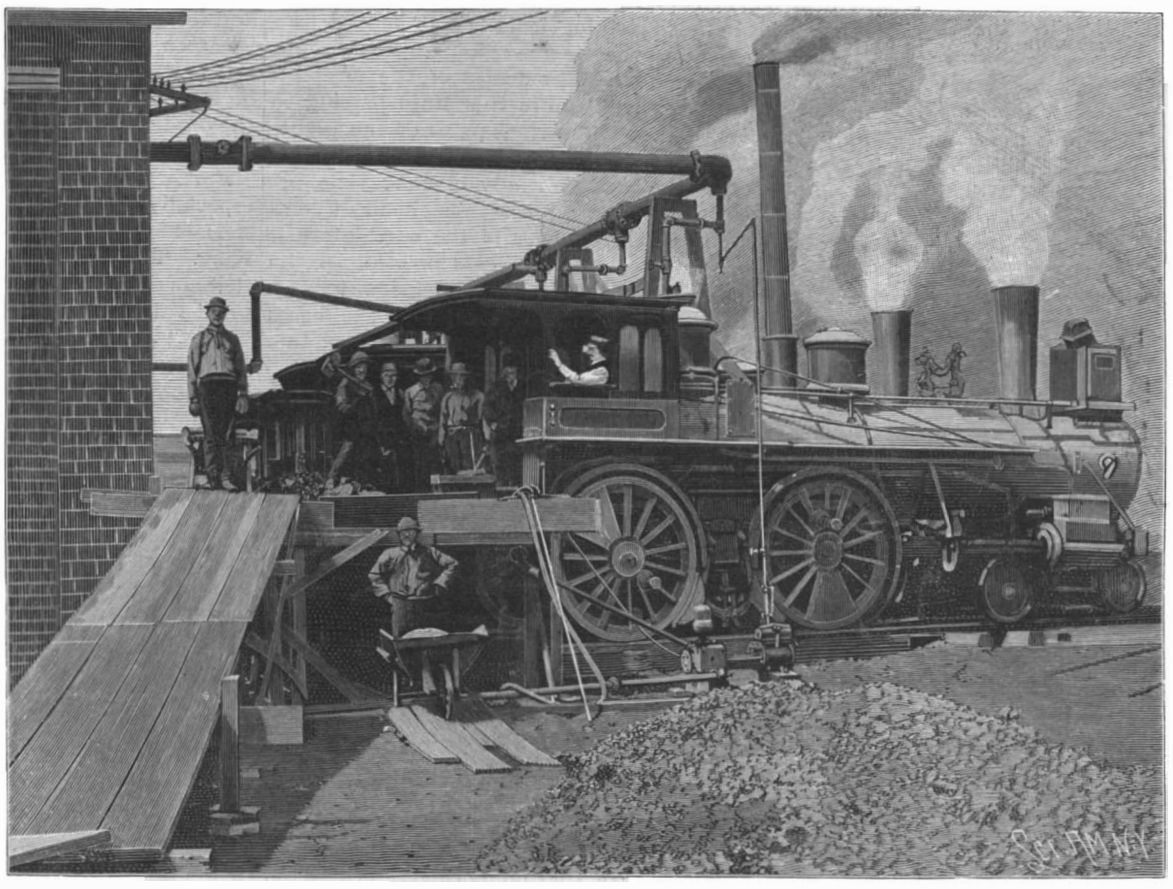
A STEAM SUPPLY FROM COMBINED LOCOMOTIVES.

Recent Tests of Position Finders.

An interesting series of tests of the position finders of Lieutenant Bradley A. Fiske, U. S. N., and Lieutenant I. N. Lewis, Second Artillery, occurred at Fort Hamilton on Tuesday, June 25, 1895, before members of the board appointed by the Ordnance Department. Broadly speaking, the work of the position finder is to plot upon a chart the position of objects both at rest and in motion, and the test undertaken by the board consisted in making estimates by the use of these instruments of the range and direction of various objects and comparing them with a known standard. The modern fort does not consist of a single inclosure, but is rather a series of isolated small forts and batteries. Many of the guns which are mounted in these forts and batteries are disappearing and are only raised at the moment of firing; and in the mortar batteries, as at Sandy Hook, the mortars are entirely concealed, being below the level of the ground, yet with the aid of position finders, which may be a mile away, it is possible for both the guns and mortars to put 45 per cent of hits on the deck of an imaginary ironclad, at ranges of from 3,000 yards to several miles. The object of the position finder is not only to assist in aiming one gun or a set of guns, but is intended to place within the power of the commanding officer of the fort the control of all of the variously disposed batteries in the fort. With his own position finder he ascertains the location of a certain group of ships and sees what batteries may be trained upon it. He then telegraphs to the batteries the position and distance he has determined, and they direct their fire accordingly, following the ships with their own position finders. If the guns were not of the disappearing type, they would need only a range finder, as non-disappearing guns can point directly at the target, using the ordinary gun sight. We have described the Fiske range and position finders in detail in the SCIENTIFIC AMERICAN SUPPLEMENTS, 788, 769 and 805. In brief, the new position finder may be said to be a simplification and amplification of the range finder. It embodies, first, a telescope moving over an arc of conducting material and which is pointed upon the distant object; second, a pivoted pointer moving over a like arc of conducting material in a Wheatstone bridge circuit with the first named arc, the arrangement being such that when the alidade arm attached to the telescope on the first arc and the pointer on the second arc stand at the same angle, the circuit is balanced; the pointer arm moves over a chart representing the area, which includes the position of the distant object on a reduced scale. On this chart there is a simple pivoted arm which can be trained directly on the object; the arm may be mechanically controlled by a telescope directed upon the object, so that it will make with the other arm an angle equal to that made by the lines of sight drawn from the two telescopes to the object. The position of the object is then shown by the intersection of the electrically directed pointer and the mechanically directed arm upon the chart. The horizontal base line is used in Lieutenant Fiske's instrument and a vertical base line in that of Lieutenant Lewis; the test was in no sense a competitive one, as the conditions under which the two systems are expected to work are very different. The Lewis instrument is available for high elevations and is simpler than the Fiske apparatus. One of the great advantages of the Lewis instrument is that it can be used with a vertical as well as a horizontal base, and in that case a 50 foot base would be sufficient.

Two temporary conning towers were erected on the north and south parapets of the fort, from which they commanded the whole lower bay, and in these the Board met for the tests. In each tower one of the telescopes of the position finder had been set up. The standard adopted for the purpose of comparison was furnished by a set of triangulating instruments, one of which was at Fort Wadsworth, on the Staten Island side of the Narrows, and the other at Fort Hamilton, the operators being connected by telephone.

Observations were made upon a stationary point, the Coney Island lighthouse being used. Other observations were taken on Hoffman and Swinburne Islands and other points of known distance with excellent results. Then a series of observations were taken on schooners and other passing craft, and afterward compared with ranges taken with a transit. In every case the Fiske position finder showed an error of much less than one per cent for each thousand yards of range, which is the standard required by both the United States and English governments. A series of tests of the Lewis depression position finder was also made with very satisfactory results.



A STEAM SUPPLY FROM COMBINED LOCOMOTIVES.

The Electrical Industry.

The electrical industry, according to the Electrical Review, is about 17 years old and employs over $1,000,000,000 of invested capital. The greater part of this immense investment has been made since 1888, when the electric motor was proved to be a success.

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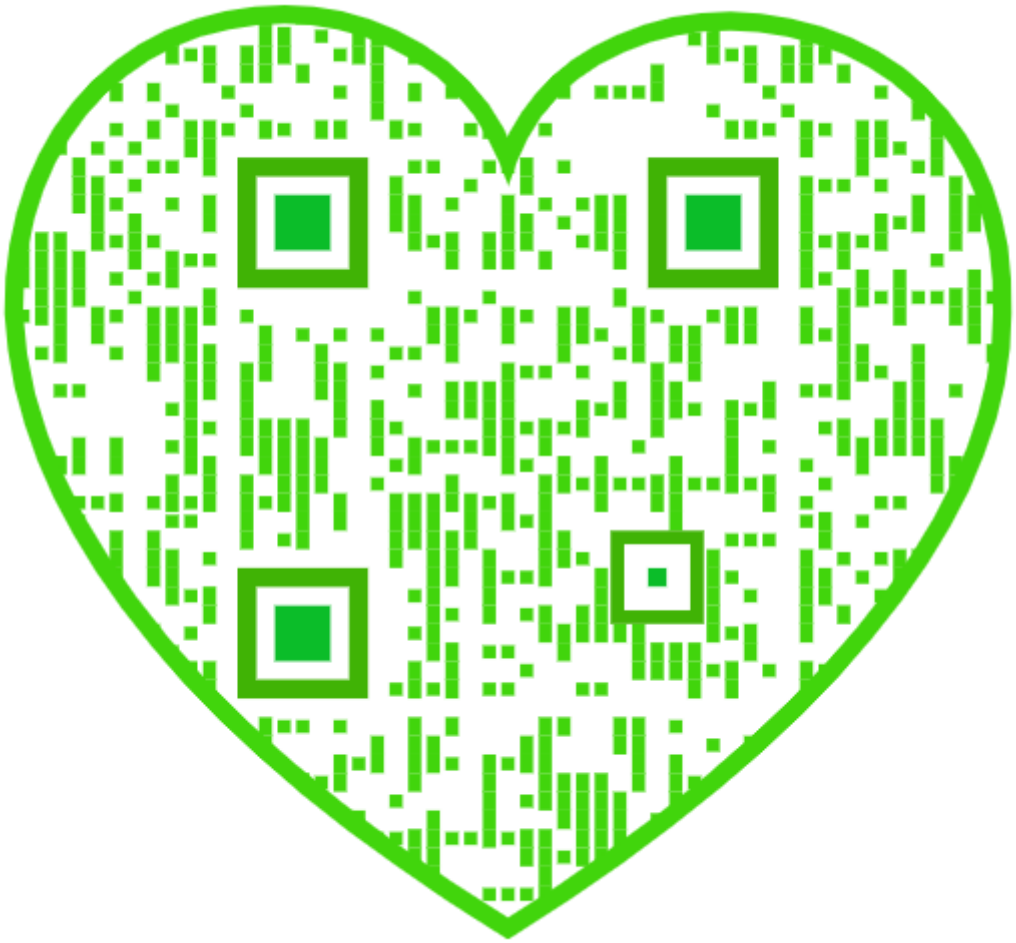

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

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NEW YORK. SATURDAY, JULY 6, 1895.

Contents.

(Illustrated articles are marked with an asterisk.)

Alcohol, percentage, determining 5
Animals, activity of 10
Animals in sterilized air 10
Armor plate annealing* 9
Baltic Ship Canal, the 11
Bicycle chain, a ribbon* 4
Bicycle "hump," the 7
Books and publications, new 12
Brine, a new, for removing snow and ice 8
Commensalism 10
Corinth Canal, the 11
Crown, royal, the English 3
Cuban insurrection, a relic* 8
Drawbridge, the Casseuil* 9
Electrical annealing* 9
Electrical industry capitalization 1
Electric lighted buoys, N. Y. harbor 8
Electric power from gas engines 3
Electric railways in Chicago 4
Electric traction motors, high speed 6
Engine, a quadruple expansion 8
Fiber, papermaking, Adansonia 3
Fibers, bast, uncultivated 7
Fires, colored 6
Fountain, the Geneva* 11
Fruit jar clamp, Dilworth's* 4
Gas engines for electric power 3
Glass, ancient 11
Gold, the fineness of 11
Gun, Maxim, tested at Sandy Hook 10
Guns, great, the manufacture of 8
Heavens, the, in July 3
Insect, a strange 6
Inventions, recently patented 12
Lantern, an astronomical* 4
Locomotives for steam supply* 1
Manchester Canal, the 11
Metal and timber, strength of 6
Notes and queries 13
Paste 4
Patents granted, weekly record 13
Poary, good weather for 5
Plants, evolution among 10
Plants, secretions in 10
Position finders, tests of 1
Railway car protector, Ingalls'* 4
Sea weeds, preserving 10
Ship canals, the new European 11
Soil analysis 2
Steamer St. Louis, new rudder for 6
Stone, the seasoning of 2
Thirst in vertebrates 10
Tree, a petrified 7
Tubes, redrawing iron* 5
Venus, interesting points of 3
Windmill, toy, Beaumont's* 4

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 1018.

For the Week Ending July 6, 1895.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ARBORICULTURE.—North American Woods.—A description of a magnificent collection of North American woods belonging to the American Museum of Natural History in Central Park.—The collection was made by Prof. Charles S. Sargent 16275
Street Trees.—The subject of beautifying our cities is now receiving great attention, and the present paper gives some valuable information regarding the planting of trees in city streets 16274
II. ARCHÆOLOGY.—Results of Excavations in the Memphis Necropolis, Dashur, and Lisht.—A description of the very recent excavation by N. G. De Morgan 16278
III. BIOGRAPHY.—Professor Lothar Meyer.—An interesting account of this great chemist by M. M. PATTISON MUIR 16271
IV. BIOLOGY.—Life Without Microbes.—Gives results of some interesting experiments 16278
V. BOTANY.—A Hybrid Tobacco.—A California specimen is illustrated.—1 illustration 16274
Vitality of Seeds.—Article by W. BOTTING HEMSLEY 16274
VI. CHEMISTRY.—Acetylene.—By Dr. F. L. SLOCUM.—An interesting paper on the new illuminant, with a comparison of its luminosity with methane, ethane, butylene, etc 16272
On Argon and Helium.—An analysis of the gas which was obtained from a meteorite 16272
Terrestrial Helium (?).—On a gas showing the spectrum of helium, the reputed cause of D^2, one of the lines in the spectrum of the sun's chromosphere.—Preliminary notes by Prof. WM. RAMSAY, F.R.S., presented at a meeting of the Royal Society 16272
VII. ELECTRICITY.—Electric Currents.—An abstract of Prof. GEORGE FORBES' recent lectures at the Royal Institution on alternating and uninterrupted electric currents.—4 illustrations 16270
VIII. EVOLUTION.—The Descent of Man.—An abstract of researches of Prof. E. D. COPE.—The paper treats of man's original ancestor, the order of succession, man's composite descent, the Neanderthal man, and man and mastodons 16273
IX. GEOLOGY.—Recent Glacial Studies in Greenland 16275
X. MATHEMATICS.—A New Method of Computing.—By E. W. SCRIPTURE, of Yale University.—2 illustrations 16270
XI. MECHANICAL ENGINEERING.—Rustless Coatings for Iron Steel.—Paints: Of what composed, how destroyed, classification as true pigments and inert substances, adulterants, etc.—By M. P. WOOD.—This installment treats of natural and artificial asphalt coatings, iron oxide paints, zinc and lead oxides, white lead, red lead, and pyrolusite paints 16265
XII. METALLURGY.—The Ohio Steel Company's Plant at Youngstown, Ohio.—A description of this large plant, with views of the Bessemer converters, the blowers, force pumps, etc., taken directly from photographs on the spot.—7 illustrations 16264
The Reduction of the Rarer Metals from Their Oxides.—By Prof. W. C. ROBERTS-AUSTEN 16269
XIII. MISCELLANEOUS.—The Chilean Hall of Congress.—A description of the Chilean Legislative Palace at Santiago, which has been totally destroyed by fire.—1 illustration 16270
XIV. NATURAL HISTORY.—Directions for Collecting and Preserving Fish.—By TARLETON N. BEAN.—From the Proceedings of the National Museum.—A very valuable article 16277
XV. ORNITHOLOGY.—The English Sparrows.—The English sparrow was first brought to this country in 1850 by the Brooklyn Institute.—A description of the increase of these birds and their migration to different parts of the country 16276
The Swallow Tailed Kite (Elanoides forficatus) 16277
XVI. PHYSICS.—On Drops.—By J. B. HANNAY.—Interesting studies made while attempting to define the standard drop.—Abstract of a paper read before the Royal Society of Edinburgh 16271
XVII. RAILWAYS.—Abstract of "Statistics of the Railways of the United States" for the Year Ending June, 30, 1894.—Treats of the mileage, classification of railways, equipment, employes, capitalization and valuation of railway capital, public service, earnings and expenses and accidents 16267
The Philadelphia and Reading Coal Storage Plants.—An interesting description of the hillsidesystem and level floor systems of storing coal 16268
XVIII. WARFARE.—Defenses Against Torpedoes.—A description of Dr. G. H. Jones' new torpedo shield.—A substitute for the torpedo net 16268
Testing the New Maxim Gun.—An account of a recent test in which six hundred shots per minute were fired 16268

RECENT PROGRESS IN SOIL ANALYSIS.

The usefulness of the chemical analyses of soils in practical agriculture has long been a theme of contention among agronomists. On the one hand the advocates of chemical analysis have contended that the agricultural value of a soil could be easily deduced from the data afforded by analysis. On the other hand, it has been affirmed with equal persistence that the data of a chemical examination afforded no just criterion of the availability of plant foods found in the sample. It is not the intention here to review these discussions, but it will be sufficient to say that there is a certain relationship between the quantities of plant food revealed by chemical analysis and the productiveness of the soil.

It is so evident, however, that this relationship is not constant that it is not necessary to cite any proof. The physical state of a soil, the climatic condition prevailing, the character of the cultivation and the nature of the crop have all to be considered and all have their influence. It has long been known that the supply of water which is furnished to the plant has more influence upon the amount of product than the fertility of the soil itself. A given field which will in one season produce a maximum crop will with practically the same amounts of plant food available in the soil in the very next season give a minimum yield. It is therefore evident that, without taking into consideration all the conditions above mentioned, no safe prognostication of yield can be based upon chemical data alone.

The principles of chemical analysis of a soil have been firmly established and especially in this country chiefly through the researches of Hilgard and Peter. While the methods of examination may vary in unimportant particulars, the general principles of procedure have remained the same for many decades. It is not believed that there can be any very important amendment of a useful nature made to the methods already in use.

The digestion of a soil of a given degree of fineness for a given length of time in hydrochloric acid of such a density as to be practically preserved at a given point of saturation throughout the whole course of solution leaves little to be desired in the way of scientific accuracy in securing the soluble constituents of a soil. On the other hand the processes of bulk analysis are based upon the well known principles of examination of minerals which have been so well established as to have suffered little change during the past few decades, nor is it likely they will suffer any great change in the future.

We must look, therefore, for progress in the line of soil analysis in some other direction than in that which has been so thoroughly investigated in the past.

Among the prominent features of recent investigation may be mentioned two which are of prime importance. In the first place attention is invited to the attempts to imitate in the chemical laboratory more nearly the solvent action of bio-chemical activity upon the plant foods present in the soil.

Every chemist has been struck with the fact that the achievements of bio-chemical activity are far more wonderful in their nature than the most brilliant achievements of the chemical laboratory. We find passing into solution in the juices which circulate through plants substances which are obtained only with the greatest difficulty and at the highest temperatures in the laboratory. We find everywhere in the vegetable world striking instances of metabolism which any chemist, even the most distinguished, would be glad to imitate. We find silicates of the most refractory nature dissolved and in this state passing to form new combinations in various parts of the plant, especially in the bark and the leaves. We find in the same juices the alkalies which only a short time before were united in the most stable chemical compounds in the mineral fragments of the earth's crust. We find compounds of mineral acids broken up, the mineral acids driven out by organic acids which ordinarily would not affect them at all and the bases with which they were combined passing in organic forms into the vegetable organism.

Evidently, therefore, in attempting to imitate in the laboratory these complicated chemical phenomena we should not lose sight of the fact that it is not possible for us to measure by our ordinary methods the power of vegetable metabolism. Nevertheless we are justified in assuming that as a rule boiling concentrated hydrochloric acid will attack mineral fragments in a way different from the organic acids which are brought in contact with them by the rootlets of the plants. Acting on this idea, it has been suggested, especially by Dyer, to substitute organic acids or their salts for mineral acids in determining the available quantities of potash and phosphoric acid in soil samples. With this idea in view the chemists belonging to the Association of Official Agricultural Chemists have been during the past year engaged in co-operative work, with a view to testing the merits of these methods of determining solubility.

It is evident, however, that no method of arbitrarily determining the solubility of plant food in soils can prove of actual value unless it be tested against the actual capabilities of plants acting upon soil of the same description. It is with this end in view that the Department of Agriculture organized a system of soil analysis in which the chemical results obtained in the laboratory are checked against the actual results obtained by experimental growth in pots. These experiments have now been under way for two years, chiefly, however, with the idea of testing the proper processes to be employed. This having been, with a certain degree of success, accomplished, the work is now considerably extended. A vegetation house has been built capable of accommodating 200 pots. These pots are kept on trucks running on rails. During the day they are run out into the open air and sunshine; during the night and in time of storms they are kept in the vegetation house, which is covered with glass. The soil which is contained in each of the pots is subjected to chemical examination in various ways and with various solvents. In this way it is believed that the actual available plant food which a soil contains, as shown by the character of the crop grown, will be by some of the methods employed indicated with a considerable accuracy by the chemical analysis.

Another most important step forward in the examination of soils consists in the methods which are now employed for determining the number and vitality of the nitrifying organisms which they contain. As is well known, the nitrogen which plants use as food can only be assimilated after it has been oxidized by passing through a vegetable organism of a lower nature. The process of changing organic nitrogen, which plants cannot assimilate, into nitric acid, which is a food suited to their needs, is called nitrification.

The process of nitrification consists of three distinct steps. In the first place, organic nitrogen is changed into ammonia. This change is produced by a number of organisms existing in the soil, the most active of which is the bacillus mycoides. The ammonia thus formed is next converted into nitrous acid by the action of a genus of organisms—nitrosomonas. The nitrous acid produced as above described is oxidized to nitric acid by another organism, the nitrobacter. But it is not our purpose here to discuss the processes of nitrification, but rather the methods which are to be employed in examining soils for these organisms. It will not be long before a chemical analysis of a soil will not be considered to be complete until the sample has been examined for the number and vitality of the nitrifying organisms which it contains. In order to make such an examination of practical value, the samples of soil must all be taken under such precautions as to exclude any contamination, and the cultures for developing the micro-organisms must all be conducted under the same conditions. In order to secure this uniformity, the Department of Agriculture has developed a method of taking the samples in sterilized tubes, under precautions which render contamination impossible, if the directions are carefully followed. The samples of soil thus obtained are used for seeding culture solutions, and the number and vitality of the nitrifying organisms in each sample can be determined by noting the time at which nitrification begins in each of the solutions, and by the seeding of sub-cultures from the original cultures employed. This work is now going on in our laboratory on samples of typical soils and subsoils taken at the agricultural experiment stations of different States, and representing the same samples that are employed in the pot cultures and for chemical analysis. By proceeding in this way, it is seen that a uniform method of chemical and bacterial examinations of the soil is secured, and the data of these examinations are checked directly against the products of vegetation secured in the experimental pots.

Further progress has already been recently made, especially in this country, in the physical analyses of soils, chiefly through the researches of Whitney and King. The separation of a sample of soil into silt particles of different degrees of fineness will give data of great value in respect of the capabilities of a soil for holding moisture and delivering it to the roots of growing plants. All the physical data obtained from the examination are of value in the final judgment, and should be considered in connection with the chemical and bacterial data obtained as above described.

The Seasoning of Stone.

Stone, like lumber, requires seasoning. Stone is often spoken of as the synonym of solidity—"as solid as a rock," we say, but, as a matter of fact, stone is very far from being solid. A cubic foot of the most compact granite, for instance, weighs about 164 pounds, while a cubic foot of iron weighs 464 pounds. This plainly shows that in between the atoms which compose the mass of the most enduring stone there exists much space for air, moisture, etc. This seasoning of stone prior to use for building purposes has been well understood by the architects of all ages, but in the modern rush of nineteenth century building too little attention has been paid to it. Now it enters into the calculations of every good architect.

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THE HEAVENS IN JULY.

The splendor of the planetary displays in the evening skies of May and June will never be forgotten by those who, looking out from the shadow of the earth into the realm of sunshine beyond, beheld Jupiter and Mars and Venus and Mercury reflecting the solar glow like a fleet of signaling ships. In exchange for this, July has only the spectacle of the continued brightening of Venus. Mercury, in the constellation Gemini, was overtaken by the sun on the last day of June, after which it became a morning star, and Jupiter, also in Gemini, will become a morning star after July 10. Mars, in Cancer, still remains an evening star, but too near the sun and too much diminished in light to attract attention.

Venus alone continues to gain in brilliance every night. Viewed with a telescope, she now appears in the shape of a half moon. On the morning of the 11th she will attain her greatest apparent distance from the sun, and after that time, as, following her orbit, she begins to swing in between the sun and the earth, her form will gradually change to that of a crescent, which will grow longer and more slender as she gets nearer and nearer into line with our globe and the solar orb. Although, as Venus turns her back to us, the proportionate part of her surface which appears from the earth to lie in the sunshine grows smaller, her continued approach more than compensates for this, and so her brightness rapidly increases. At the middle of the month she will be twice as bright as she was on May 1, and between the beginning and the end of July she will gain more than one-third in brightness. Even then she will not have reached her greatest brilliance; that will occur about two weeks later.

As I remarked in a former article it seems to me that of all the planets belonging to the sun, besides the earth, Venus is the most likely to be now in a suitable condition to nurture living creatures resembling the inhabitants of our globe. The fact that she so nearly resembles the earth in size and mass is one of the strongest à priori reasons for this opinion. There is no planetary function so important in respect to the question of habitability as the force of gravitation. That governs the density of a planet's atmosphere, the circulation of its fluids, the ratio of the size of its inhabitants to the strength of their framework, all the mechanical processes and operations occurring upon its surface, etc. Now on Venus the superficial gravity is about 83 per cent of that on the earth. In other words, a weight of 100 pounds here if removed to Venus would weigh 83 pounds there. So slight a difference would probably produce no serious effect upon the conditions of habitability of Venus for creatures of terrestrial mould. The case is quite different for Mars, where the force of gravitation is only 38 per cent of its force here, and also for Jupiter, where the superficial gravity is 2·64 times as great as on the earth. It is true that judged by this test alone Mercury and Uranus might also be regarded as probably inhabited planets, since on the former the superficial gravity is five-sixths of the earth's, and on the latter nine-tenths, but in the case of those planets other considerations come to the front. Mercury, for instance, would seem to be too near the sun, to say nothing of the great eccentricity of its orbit, while Uranus is too far from the sun, receiving, as it does, surface for surface, only one 368th part of the solar light and heat that the earth gets. On Saturn, too, the force of gravitation would offer no obstacle to the existence of terrestrial forms of life, since it exceeds the earth's force only one-fifth, but there are many reasons for believing that the physical condition of Saturn is very different from that of our globe.

Moreover, Venus bears a striking resemblance to the earth, not merely in the conditions governing the weight of bodies at her surface, but also in the undoubted possession of an atmosphere containing watery vapor, in the similarity of her mean density, and probably in the practically identical period of her axial rotation. Indeed, there are two particulars in which Venus would seem to possess a possible advantage over the earth; the first being that her axis appears to be nearly or quite perpendicular to the plane of her orbit, from which it results that her seasons are uniform—always summer near the equator, always spring in middle latitudes, and always winter in the far north and south—and the second that her orbit is so nearly a circle that her distance from the sun is, for all practical effects upon climate, invariable. The intensity of the solar radiation is nearly twice as great on Venus as on the earth (in the inverse ratio of the squares of their mean distances), but inasmuch as the telescopic appearance of the planet suggests that it is deeply shrouded with clouds, the greater degree of light and heat received may, in this case, not be disadvantageous.

Everything considered then, it is to be regretted that our knowledge of the surface appearance of Venus should be so limited as it is. Schiaparelli has indicated one way in which the difficulty arising from the blinding brilliance of Venus may be avoided, namely, by studying the planet telescopically in broad day, and has himself set the example. Our best equipped observatories ought to be able to tell us something more about that other earth whose distant beauty just now lends so great a charm to the sunset heavens.

Saturn is following the other planets in an apparent march sunward, and now crosses the meridian during the evening twilight, but it will remain an evening star until the 1st of November, and during July will be fairly well placed for observation. It is in the constellation Virgo, about ten degrees east of the bright star Spica. Its beautiful rings still present a most admirable spectacle for a small telescope.

Uranus remains in Libra, a few degrees in an easterly direction from the star α.

Mercury, which, as already remarked, became a morning star at the end of June, will attain its greatest distance west of the sun on the 22d, about which time it may be seen before sunrise.

The month opens with the moon near first quarter. The moon fulls on the 6th, about half past six o'clock in the evening, when it is situated in Sagittarius, near the "Milk Dipper." It reaches last quarter on the night of the 14th, at 10:30 o'clock, in the eastern part of Pisces, and new moon occurs on the 22d, at 32 minutes after midnight. The moon is in perigee, or nearest the earth, on the morning of the 23d and in apogee on the morning of the 11th. The moon will be near Venus on the evening of the 24th and near Saturn on the evening of the 28th.

The earth is in perihelion, or nearest to the sun, on the 1st, about an hour before midnight. Mars is in perihelion less than three days later, but this means more for Mars than it does for the earth, because the former is no less than 13,000,000 miles nearer the sun at perihelion than at aphelion, while the change of distance for the earth between the corresponding points in its orbit amounts to only 3,000,000 miles.

Possessors of small telescopes will be interested this month in the following among other beautiful objects:

Beta Cygni, the splendid colored double star—light orange and deep blue—situated in the foot of the Northern Cross in the constellation Cygnus. Epsilon Lyræ, the celebrated quadruple star near the brilliant Vega. A good 3 inch will easily divide both of the pairs composing the quadruple. The Ring Nebula between the stars Beta and Gamma in Lyra. A 3 inch will show it. 61 Cygni, an easily separated pair of small stars, until recently regarded as the nearest in the northern hemisphere of the heavens; and finally, the gorgeous star fields to be found scattered along the Milky Way, which at 9 P. M. about the middle of the month will be seen starting from Perseus, then just rising in the northeast, and passing in succession through Cassiopeia, Cepheus, Cygnus, Lyra, Aquila, Ophiuchus and Serpens, until, spreading widely as it enters Sagittarius and Scorpio, it disappears behind the horizon in the south. This star-jeweled baldric is the chief adornment of a midsummer's night.

GARRETT P. SERVISS.

Adansonia Fiber in Paper Making.

Adansonia bark is chiefly used for the preparation of strong wrapping papers, cartridges, and emery paper. In point of strength the fibers obtained from it are only surpassed by those from the mulberry bush. Papers made with an addition of adansonia fiber not only possess greater tensile strength, but offer greater resistance to tearing. This is characteristic of such papers in a marked degree, and is due to the long, strong fibers intermingling with the others in the sheet of paper. The fibers under the microscope exhibit so distinctive an appearance that they cannot be easily confounded with other fibers.

To obtain the fiber from the raw bark on the manufacturing scale, the adansonia is first of all cut into small pieces about an inch or an inch and a half long with an ordinary rag chopper, or by hand with strong knives. If it is desired to bleach the fiber after chemically treating the cut bark, it is necessary to subject the raw stuff to a system of purification to remove knots, etc. For unbleached papers this purification is not necessary beyond the usual dusting. When the material has been cut and dusted, it is placed in a revolving boiler, and there boiled for ten hours or so, according to what is considered necessary, in a caustic soda lye containing 3½ per cent of soda in the state of caustic and under a maximum pressure of fifty-five pounds above atmosphere. It is usual, in actual practice, to soak the bark in the lye within the boiler, and to see that it is covered with liquor before raising the pressure. The object of this is to prevent the fiber becoming discolored, direct steam having the tendency to darken it.

If the fiber is properly boiled, the particles of fiber should easily pass between the fingers when lightly pressed, and feel strong and tough. The pulp should not be allowed to lie long, owing to a species of fermentation setting in which destroys the strength of the fiber. It is usually worked up immediately after being boiled.

The pulp from the boilers is then washed in the breaking and washing engine, a process which takes a long time, owing to the slimy nature of the incrusting matter surrounding the fiber stopping up the wire cloth covering the washing drum. This latter is brushed at intervals to keep it open. Pure clean water must also be used, and the breaking-in roll should be adjusted to thoroughly open out or brush the fiber only, thus preserving its full length.

The preparation and bleaching of the fiber is very similar to jute and manila and such like raw stuffs. The difficulty of bleaching to a good white color with a reasonable amount of bleaching power is also apparent in practice, and depends largely on the nature of and the care with which the chemical treatment has been carried out in the boiling. The loss in weight which the raw adansonia undergoes varies from 50 to 60 per cent, that is to say, 100 parts of adansonia bark will yield from 40 to 50 parts of paper. Papers made from adansonia fiber alone are not frequently to be met with, the bulk of the fiber being used in conjunction with others in making compound papers. These compound papers possess a strength in proportion to the quantity of adansonia fiber used in their manufacture.—Chem. Tr. Jour.

Electric Distribution of Power from Gas Engines.

Captain Lenevue, of France, has recently made a report upon the power installation at M. Linet's chemical works at Aubervilliers, near Paris. The power is generated by gas engines worked with poor gas and transmitted by electricity throughout the works. The plant is considered a model one of its kind.

The complete generating plant consists of three 80 horse power "Simplex" gas engines, placed side by side and capable of working separately or together, each engine driving a dynamo by a belt through an intermediate shaft, to which is also belted a lighting dynamo and a pump. The shaft is provided with couplers. There are also two steam engines that were used before the gas plant was put in. Each generator is of 56 kilowatts, as is also the lighting dynamo, and about twenty motors of from 4 to 15 kilowatts are placed at convenient points about the works. At present only one of the power generators, the lighting dynamo and six motors are in use. The first two exert a useful effect of 91 per cent at 450 amperes, falling to 75½ per cent at 130 amperes. The efficiency of the 18 horse power motors is 89 per cent; of the 9 horse power, 88 per cent; and of the 5 horse power, 86 per cent.

The results of the test of this plant made by Captain Lenevue and the engineer of the works are as follows:

Circumference of the pulley on which the friction brake was mounted	21 feet 9 inches.
Diameter of ditto	6 feet 11 inches.
Circumference of brake's action	22 feet.
Diameter of ditto	7 feet.
Diameter of cylinder	23 inches.
Piston stroke	30 inches.
Net total coal consumed	511 pounds.
Duration of trial	4 hours 19 minutes.
Mean speed (per minute)	120,220 revolutions.
Indicated horse power	81·42 horse power.
Organic yield or useful effect	0·769.
Maximum horse power at the brake	95·81 horse power.
Maximum indicated horse power	124·518 horse power.
Indicated horse power of the small motor, estimated at	4 horse power.
Indicated horse power of the two motors	109·81 horse power.
Coal consumed per hour	118·56 pounds.
Coal consumed per brake horse power hour	1·457 pounds.
Coal consumed per indicated horse power per hour	1·12 pounds.
Coal consumed per indicated horse power per hour by the two motors	1·08 pounds.

The Royal Crown of England.

The crown used at the coronation of Queen Victoria in 1838, which is said to be the heaviest and most uncomfortable diadem in Europe, contains 1,273 rose diamonds, 1,363 brilliants, 273 round pearls, four large pendant shaped pearls, one immense ruby, four smaller rubies, one large sapphire, 26 smaller sapphires and 11 emeralds. The large ruby is set in the center of a diamond Maltese cross at the front of the crown. This stone was given to Edward I by Don Pedro the Cruel, and was worn by Henry V at the battle of Agincourt, when it was set in his steel casque. It is peculiarly cut and its center is hollowed out to form a setting for a smaller ruby. Many of the stones were taken from old crowns now unused and others were furnished by the Queen herself. They are placed in settings of both gold and silver and incase a crimson velvet cap with an ermine border. Four imperial arches spring from the four sides and support the mount, which is composed of 438 diamonds, and the whole is surmounted by a diamond cross whose center is a single rose cut sapphire.

IT is proposed to include an international exhibition of aeronautical apparatus among the interesting features of the Paris Exposition of 1900. The sub-committee on aerostation in charge of the matter are making preparations for the admission of balloons of all kinds, flying machines and soaring apparatus of every description. The competition for honors will, it is stated, be open to foreigners and French inventors on equal terms. Commandant Renard is at the head of the committee.

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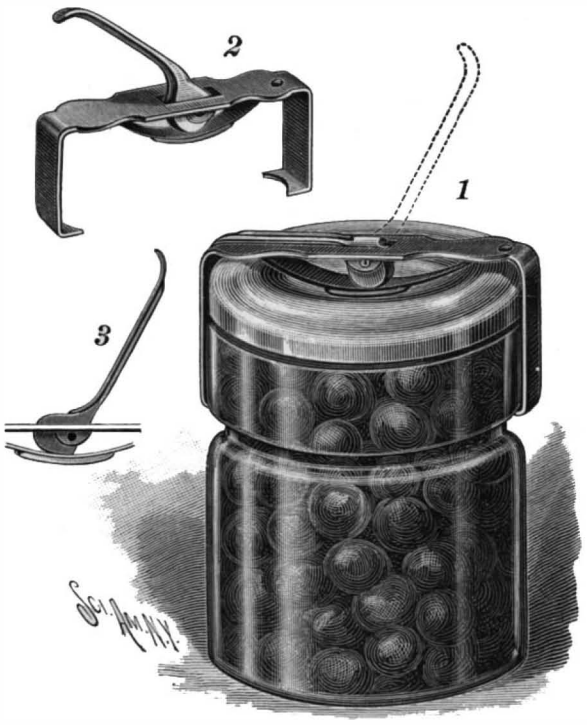
AN IMPROVED FRUIT JAR CLAMP.

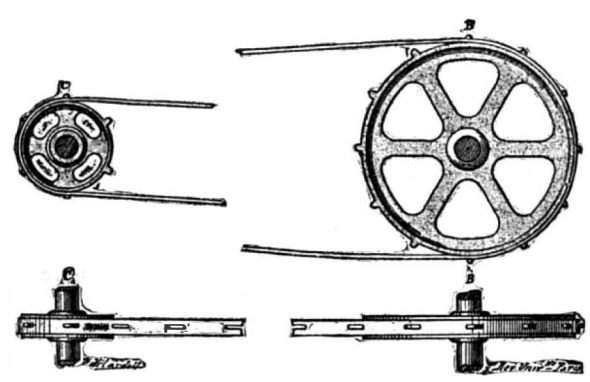
The illustration represents a strong and inexpensive clamp, readily applicable to a fruit jar and cap, and adjustable to make a watertight seal, so that the jar may be held submerged without permitting water to run into it. The clamp has a yielding fastening device which permits any gas or steam that may be generated to escape, but it may be quickly adjusted to bind the cap rigidly in place and make a hermetical seal. The improvement has been patented by Mr. Henry C. Dilworth, of No. 563 Greenwich Street, New York City. The main clamping piece has inturned flanges which fit beneath the rim ordinarily found on fruit jars, the cap resting on the usual gasket, and on the under side of the clamping piece is a flat curved spring, one end of which is fastened to the clamping piece, and there being centrally on the under side of the spring a cushion, to prevent the spring from contacting directly with the cap. In a central slot of the clamping piece is pivoted a locking lever carrying cams adapted to bear centrally upon the spring. In the illustration, Fig. 1 represents the clamp applied to a fruit jar, the cam pressing firmly upon the spring when the locking lever is turned down, and at the same time drawing upon the main clamping piece to firmly lock the cap and make a hermetical seal. In the different positions of the locking lever indicated by the dotted lines and in Figs. 2 and 3, the cams are released from engagement with the spring, and the clamp may be readily slipped on or off the top of the jar. With this adjustment the spring presses down on the cap with sufficient force to prevent water from running into the jar when it is submerged for cooking or other treatment, although the pressure is not so great but that gas or vapor generated may escape without breaking the jar. Patents have also been obtained for this invention in Canada and the principal European countries.



DILWORTH'S FRUIT JAR CLAMP.

A RIBBON SUBSTITUTE FOR BICYCLE CHAINS.

The advent of the safety bicycle rendered some means of connecting mechanism a necessity; gear wheels, bevel wheels and the chain and sprocket wheel were all tried, and at the present time the latter system appears to be the most popular. The chain, however, has marked disadvantages, such as weight, difficulty of properly cleaning and lubricating, and, lastly, on account of the liability to fracture at one of the many joints. The wire cable, in spite of its lightness and strength, has not been applied practically to bicycles on account of the imperfection in the means proposed to assure adherence on the pulleys. The metallic ribbon has several advantages to recommend it, as its lightness, flexibility, its strength, and its absence of joints. As with the wire cable, it was found that it was very difficult to secure good adhesion on the pulleys unless the ribbon was very taut, which, of course, detracted from its strength. These difficulties were obviated by using a special ribbon made from a steel analogous to that used in piano wire, and at regular intervals orifices are cut. The sprocket wheel engages the ribbon with the aid of these holes. The relative size of the wheels is the same as usual. The number of teeth on the sprocket wheel is decreased. The ribbon can be cleaned in a moment. For our engraving and the above particulars we are indebted to the Revue Universelle.



A RIBBON SUBSTITUTE FOR BICYCLE CHAINS.

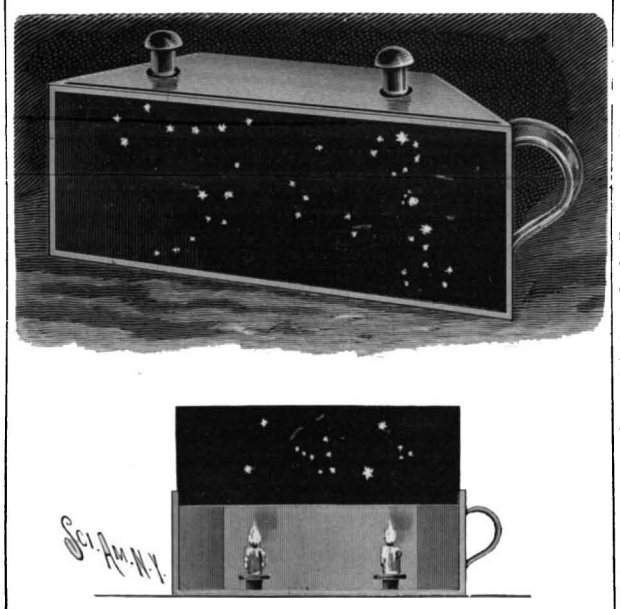
The Electric Railway in Chicago.

Electric lines now connecting with the business center of Chicago, either completed or under way, give a grand total of 500 miles. The benefit of such transportation facilities to a city can hardly be overestimated, for the speed of travel will average nearly eight miles per hour or twice that of horse car lines. Since the opening of some of the new electric lines, a few weeks ago, a great improvement has been noticed and favorably commented upon by nearly every one. In the outer portions of the city, or six, seven and eight miles from the business center, the number of new buildings being erected would lead a person to believe that there was a boom in building. Residence as well as business property has increased noticeably in value.

The operation of the trolley lines is almost perfect, as the cars run smoothly and without delay, there being very few accidents to persons or machinery. About six months from now the city limits in any direction can be reached from the business center by street car lines in about one hour. The benefit to the city on account of the time thus saved will be inestimable. The lines already projected will bring every block within the city limits within easy walking distance from the car lines.—Stationary Engineer.

AN ASTRONOMICAL LANTERN.

With the simple form of lantern shown in the illustration, and easily made small maps or charts of the star groups, a great deal of instruction and entertainment may be realized. The lantern body may be of tin or wood, with flues to afford the necessary ventilation, and in one side has slideways, to facilitate the placing of the diminutive star charts in position in the side of the lantern. The lantern may be readily carried in the hand, and an illuminated chart thus representing any particular group of stars in the heavens greatly facilitates the finding of the group, furnishing most interesting and very simple star lessons. For the charts or maps, a simple blue print is found quite sufficient, where regularly prepared slides are not obtainable, and such prints may be made from originals prepared by the observer, or copied from any of the numerous publications in which star maps are given.



A LANTERN AID TO STAR OBSERVATION.

Paste.

J. H. Baldock, in a discussion on the use of starch as a mountant, pointed out that the starch must be brought into a state of disintegration, not solution, the usual plan being to make it into a cream with cold water, and then, while constantly stirring, pour on boiling water until thickening takes place. More complete disintegration is obtained, however, by subsequently boiling for a few minutes, while a clearer jelly is obtained, and better keeping properties are secured. The paste should not be too thick, and if not made fresh at the time of using, should be boiled well, and have a little boric or salicylic acid or oil of cloves added as a preservative. Alum is objectionable in starch paste for photographic purposes. H. D. Gower said he prepared a paste that kept well by adding an ounce of starch to half a pint of water and heating, with constant stirring, until thickening occurred. Heat for a few minutes longer, remove from the source of heat, add half an ounce of glycerin and, when nearly cold, half an ounce of methylated spirit. A few drops of oil of cloves or other essential oil may be added if desired, but this is not necessary.—Photography.

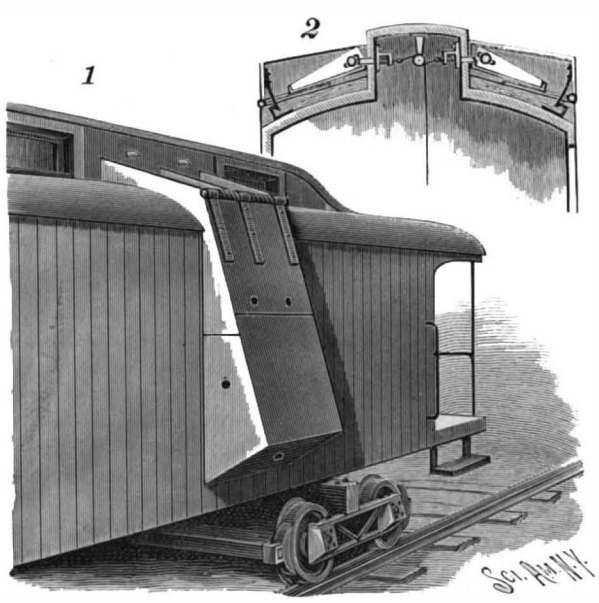
A DOUBLE ROTARY TOY WINDMILL.

The attractive toy for children represented in the illustration has been patented by Mr. Frederick Beaumont, Jr., of No. 1307 Franklin Street, Kansas City, Mo. It has two wheels, one inside the other, which revolve in opposite directions at the same time. The small figure is a side view of the device. The wheels and vane may be of wood, tin, paper, celluloid, etc., and in bright colors, and the vane presents obvious advantages for use for advertising purposes.

BEAUMONT'S TOY WINDMILL.

A BULLETPROOF DOOR AND WINDOW SHIELD FOR MAIL AND EXPRESS CARS.

This improvement, for preventing the felonious entrance of train robbers to mail and express cars, has been patented by Mr. Charles G. Ingalls, of Waucedah, Mich. It consists of a two-part shield of plate metal, shown applied and in lowered position over a car door in Fig. 1, while Fig. 2 is a sectional view representing the shields for opposite doors folded up on the roof of the car. The upper section is strongly hinged to the side of the car body, the hinges having their joints connected by a single pintle rod around which is a coiled spring, to aid the quick descent of the shield when required. The side edges of both sections are flanged and tapered, a flange on the lower edge of the lower section joining the side flanges, and the lower section having an overlapping contact with the adjacent portions of the upper section, there being duplicate spring-jointed connections between the lapped portions of the sections. There are pivotal connections between the lapped portions of the shield sections, which are retained in close contact when the shield is lowered by spring latch hooks. The shields are held in their folded position on the car roof, with the lower section imposed on the upper section, by detent hooks and a locking mechanism arranged to permit the simultaneous release of both sections upon the pulling of a cord or band which hangs pendent in the car, the shields being then instantly thrown into a depending and locked position, as shown in Fig. 1. In each of the shields are perforations through which occupants of the car may shoot at would-be train robbers.



INGALLS' CAR PROTECTOR.

EXPERIMENTS are being made in the German army with the use of an aluminum pontoon. It can easily be carried by four men.

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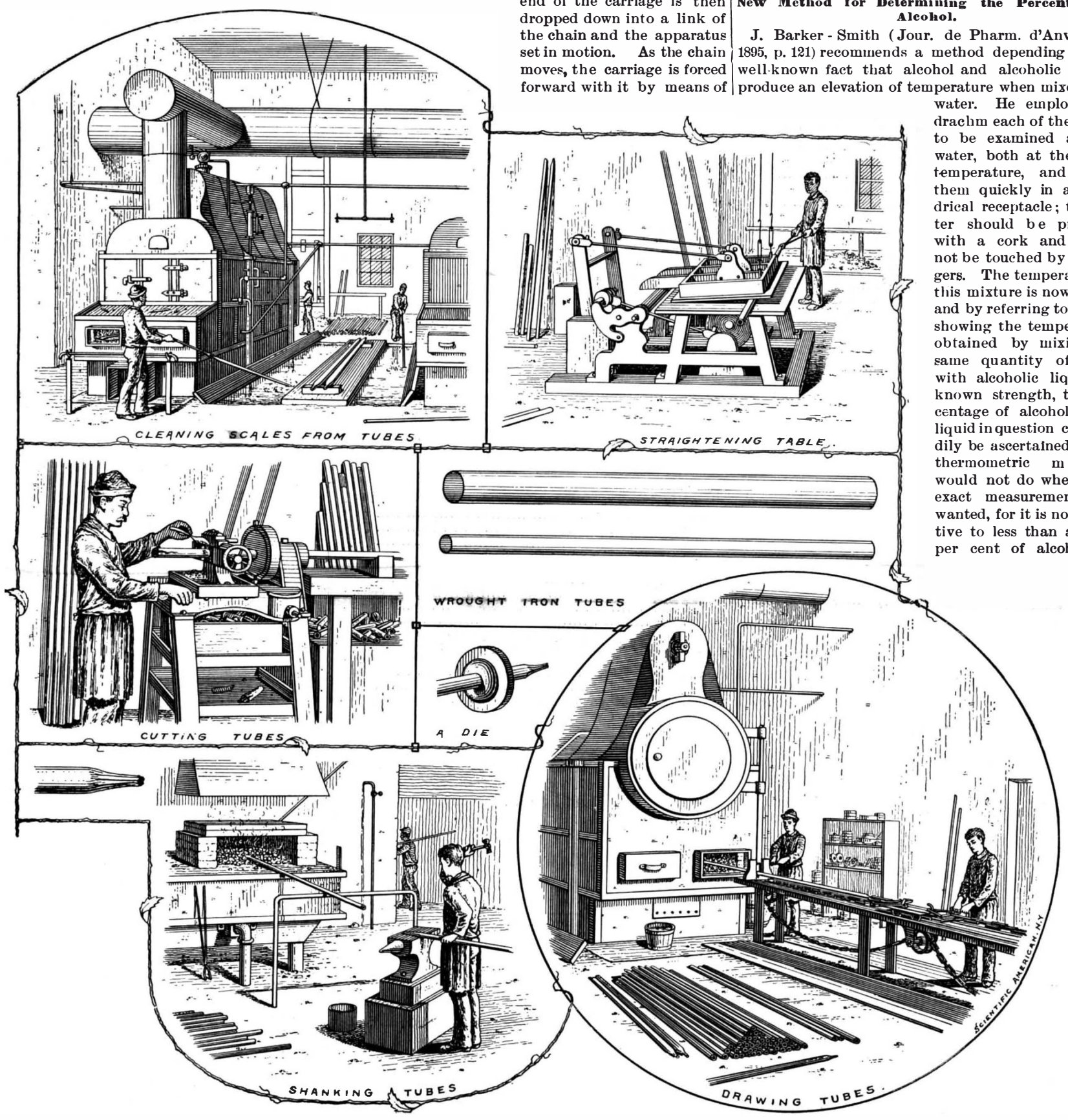
REDRAWING OF WROUGHT IRON TUBES.

Redrawn wrought iron pipes or tubes are old stock that has been collected up, reheated and drawn through circular steel dies which press the tubes into the right diameter. This stock, which consists of old boiler tubing, railings, etc., is first heated red hot in a furnace. The furnace has two ovens or fire boxes each 15 feet in length, about 18 inches in width and about 8 inches in height and lined with fire brick. These fire boxes also heat the boiler, which is incased in the brickwork above. In one of the ovens a number of the old tubes are heated, the attendant, as soon as they become red hot, removing them by means of tongs and placing them in a dipping tank or reservoir containing cold water. This reservoir is about 18 inches in width and 24 inches in depth. As soon as the hot tubes come in contact with the water the dirt and scale instantly drop off, giving the pipe a brand new appearance. When cool they are shanked by heating one end of the tube red hot in a furnace, then hammering the heated end to a point on an anvil. The object of shanking is to have a good strong end for the jaws on the pulling carriage to catch hold of when the tube is drawn through the die. If the pipe was not shanked, the material would break off. After shanking the tubes are placed in the other fire box of the furnace and heated up to a white heat, about 1,500° F. Running from the mouth of the furnace is a draw bench about 21 feet in length and 10 inches in width. On this bench, traveling back and forth on a track, is a pulling carriage, connected to the front end of which are two movable steel jaws 8 inches in length and 1½ inches in width. At the head of the draw bench is an iron head block, against which the circular steel dies are held in position. Passing along the center of the draw bench and between the wheels of the carriage is an endless chain 45 feet in length. This chain is connected to the machinery and travels at the rate of about 80 feet per minute, running over a number of spiked 10 inch pulleys connected to the draw bench underneath. The dies are about 8 inches in diameter on the outside. The inside diameter where the pipe runs through ranges from 1 to 6 inches. The flanges on the dies are about 1 inch in thickness, the center or oval part being about 3 inches thick.

When the heated tube is ready, an attendant places the flat side of the die against the head block. The tube is then drawn out of the furnace with a pair of tongs and the flanged end cooled with water. The end is then run through the die into the jaws on the pulling carriage, which, when drawn taut, grips the end of the tube firmly. A movable hook attached to end of the carriage is then dropped down into a link of the chain and the apparatus set in motion. As the chain moves, the carriage is forced forward with it by means of the hook, drawing with it the red hot pipe through the die. The pipe, as soon as it is passed through the die, is reheated and drawn through another die a little less in diameter. This operation is repeated, using every time a smaller die until the right size tube has been obtained. About 1,500 feet of tubing is redrawn per day, it requiring the labor of three men. After the redrawing operation is finished the red hot tube is placed on the straightening table, over which slightly inclined is a movable flat iron frame which moves back and forth when the machine is in motion over the pipe. This frame, which is about 5 feet in length and 2½ feet in width, makes an 18 inch stroke. The weight of the frame, which is about 1,000 pounds, straightens the pipe in about one minute. After straightening, the tubes are carefully examined to see that there are no flaws in them. The parts to be cut off are marked by the examiner, who then passes them to the cutter. The pipe is placed in the machine and the knife or cutter put in position. The machine is then set in motion and the knife forced against the revolving pipe, which makes about from 25 to 40 revolutions per minute, according to the size of the tube, and is cut through in about two minutes. The knives are made of steel about 4 inches in length, about 1 inch in width and about ⅛ of an inch in thickness.

The machine will cut from 25 to 30 pipes per hour. During the cutting operation softsoap is applied, which keeps the knife from getting heated and also makes the material cut easier. The pipes when finished are used principally for boilers, green houses, hot water purposes, railings, paper rollers, etc.

The sketches were taken from the plant of the Eagle Tube Company, Jersey City, N. J.



THE TUBE REDRAWING INDUSTRY.

New Method for Determining the Percentage of Alcohol.

J. Barker-Smith (Jour. de Pharm. d'Anvers, li, 1895, p. 121) recommends a method depending on the well-known fact that alcohol and alcoholic liquids produce an elevation of temperature when mixed with water. He employs one drachm each of the liquid to be examined and of water, both at the same temperature, and mixes them quickly in a cylindrical receptacle; the latter should be provided with a cork and should not be touched by the fingers. The temperature of this mixture is now taken, and by referring to a table showing the temperatures obtained by mixing the same quantity of water with alcoholic liquids of known strength, the percentage of alcohol of the liquid in question can readily be ascertained. This thermometric method would not do where very exact measurements are wanted, for it is not sensitive to less than about 5 per cent of alcohol. It would, therefore, not answer for testing wines containing 10 per cent or less of alcohol. One point raised in its favor is that substances in solution do not interfere much with the test.

The above is a convenient and rapid process for determining the alcoholic strength of liquids containing a large percentage of alcohol, such as whiskies, brandies, tinctures, fluid extracts, menstrua, etc. —Merck's.

Good for Peary.

The past winter in Greenland was unusually mild, and the climatic conditions have favored Mr. Peary's expedition. The barks Silicon and Salina, the first of the fleet of cryolite traders to arrive at Philadelphia from Ivigtut, report that the Greenland coast has not been choked with ice as usual, while the brilliancy of the aurora made the long winter night almost like day.

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Colored Fires.

Usually at this season of the year there are calls for colored fires; the following from Merck's Report, which it says are approved formulas, may be of interest. On account of the poisonous and explosive nature of some of the ingredients, the utmost care in their manipulation is necessary.

BLUE.

	Parts.
1. Realgar	2
Charcoal	3
Potassium chlorate	5
Sulphur	13
Calcium nitrate	77

or:

	Parts.
2 Orpiment	1
Charcoal	1
Black antimony sulphide	16
Potassium nitrate	48
Sulphur	64

The objection to almost all blue fires is that when burned they generate arsenical fumes, and are, therefore, not suitable for indoor use. A blue which can be used in a theater or large hall, though less brilliant than the foregoing, may be made as follows:

	Parts.
3. Sulphur	15
Potassium sulphate	15
Ammon. copper sulphate	15
Potassium nitrate	27
Potassium chlorate	28

CRIMSON.

	Parts.
4. Potassium chlorate	17
Charcoal	23
Sulphur	90
Strontium nitrate	270

or:

	Parts.
5. Charcoal	18
Antimony sulphide	22
Potassium chlorate	69
Sulphur	72
Strontium nitrate	220

GREEN.

	Parts.
6. Potassium chlorate	13
Barium nitrate	66
Sulphur	21

or:

	Parts.
7 Metallic arsenic	2
Charcoal	3
Potassium chlorate	5
Sulphur	13
Barium nitrate	77

or:

	Parts.
8. Charcoal	2
Black antimony sulphide	2
Potassium chlorate	5
Sulphur	6
Barium nitrate	80

LILAC.

	Parts.
9. Black copper oxide	6
Chalk (dry)	20
Sulphur	25
Potassium chlorate	49

PINK.

	Parts.
10. Charcoal	1
Chalk	20
Sulphur	20
Potassium chlorate	27
Potassium nitrate	32

or:

	Parts.
11. Sulphur	16
Calcium chloride, dried	23
Potassium chloride	61

PURPLE.

	Parts.
12. Lampblack	1
Realgar	1
Potassium nitrate	1
Sulphur	2
Potassium chlorate	5
Strontium nitrate, fused	16

or:

	Parts.
13. Copper sulphate	39
Sulphur	52
Potassium chlorate	310

RED.

	Parts.
14. Charcoal	1
Black antimony sulphide	4
Potassium chlorate	5
Sulphur	13
Strontium nitrate, dried	40

or:

	Parts.
15. Sulphur	16
Strontium carbonate	23
Potassium chlorate	61

or:

	Parts.
16. Antimony sulphide	4
Potassium chlorate	5
Sulphur	13
Strontium nitrate, fused	40

A little charcoal or lampblack makes it burn quicker.

VIOLET.

	Parts.
17. Charcoal	8
Sulphur	10
Metallic copper	15
Potassium chlorate	30

or:

	Parts.
18. Alum	3
Potassium carbonate	3
Sulphur	4
Potassium chlorate	15

WHITE.

	Parts.
19. Potassium nitrate	30
Sulphur	10
Black antimony sulphide	5
Meal powder	3
Powdered camphor	2

or:

	Parts.
20. White arsenic	1
Charcoal	2
Black antimony	16
Potassium nitrate	48
Sulphur	64

YELLOW.

	Parts.
21. Potassium nitrate	2
Sulphur	4
Sodium nitrate	20
Lampblack	1

or:

	Parts.
22. Sodium nitrate	3
Potassium chlorate	1
Shellac	1

In the preparation of colored fires the ingredients, which should be perfectly dry, must be separately powdered and sifted through a hair sieve, and put into well stoppered, wide mouthed bottles until ready for mixing. The mortar must be thoroughly cleaned, before and after powdering each ingredient, particularly potassium chlorate. Mix with the hands or with a wooden spatula on sheets of white paper.

Sulphur, and salts of the poisonous metals—antimony, arsenic, mercury, etc.—should not be used in making colored fires for indoor use. The sulphur may advantageously be replaced by shellac, which hardly smokes at all when ignited.

For red the following formulas are used:

	Parts.
23. Potassium chlorate	1
Shellac	1
Strontium nitrate	3

or:

	Parts.
24. Strontium nitrate	12
Potassium chlorate	8
Milk sugar	1
Stearin	2

For green the following is employed:

	Parts.
25. Potassium chlorate	2
Barium nitrate	1
Milk sugar	1

High Speed of Electric Motors.

Some interesting trials on the Nantasket branch of the New York, New Haven & Hartford Railroad occurred June 20 and June 22. The Nantasket Beach branch was chosen for the experiment for the reason that within its limits will be included most of the different problems which will have to be determined to make electricity a successful substitute for steam. The curves are many and sharp, the grades are steep and trains will be run with great frequency. Seven miles is the distance between the Old Colony station and Pemberton. The tracks are fifteen feet apart from center to center, and between the tracks is a single line of poles on which are supported the cables and trolley wire. Upon the tangents the poles are set with such geometrical precision as to secure absolutely perfect alignment. The two flexible copper bonds seven inches long are under the base of the rail at each joint and riveted to each rail. A power house, No. 1, is situated midway between the terminals and contains two tandem compound engines; the two generators develop fifteen hundred horse power each. Four motor cars have been built after the style of baggage cars. To secure traction they have been made extra heavy, so that when fully equipped they will weigh about 60,000 pounds each. Two will have four motors each and the other two motors each hung on trucks. The cars are equipped with the Westinghouse air brake, and in addition to a 15 inch gong, there will be a chime whistle worked by compressed air. The test was held in the presence of only a few invited guests. There was none of the gradual increase of speed characteristic of the steam locomotive. A test was made of a load of 175 tons, equal to a train of seven cars, but the ease of starting and the speed obtained showed that a load of three or four times as great could be easily drawn. A speed of more than 50 miles an hour was obtained, and for a part of the distance it was estimated that the train made at times the enormous speed of 80 miles per hour. A hot box prevented a greater increase of speed. When the train was making 80 miles an hour there were still five notches left in the "controller" in the motor, so if the additional current had been applied, it is thought that a speed of 90 miles an hour might have been obtained on the level stretches.

The New Atlantic Steamer St. Louis.

The St. Louis finished her second voyage at New York on June 22, 1895, completing the passage from Southampton in seven days, seven hours and eleven minutes. The outward passage was made in seven days, three hours and fifty-three minutes. When three days out from Southampton, while proceeding in the face of a heavy wind, the ship would not respond to her rudder. An inspection was quickly made of the machinery, which was found to be working perfectly. The hand steering apparatus had been used, and that was tested, but the St. Louis would not respond; a sailor was sent over the stern to see what was the trouble. He discovered at a glance that the bracing plates of the twenty-seven ton rudder had broken and that the fracture extended diagonally upward from the pintle of the rudder; there was therefore no leverage for the steering gear and the ship was practically helpless as far as her rudder was concerned. The captain and chief engineer decided that the twin screws should be used to guide the vessel, so they shifted the action of the port and starboard engine as the course demanded and the St. Louis forged ahead with little diminished speed. The accident was due to a hidden flaw in the steel of which the rudder was made. The rudder was taken off when she reached her dock and that of her sister ship, the St. Paul, was substituted, the work being quickly done, and the St. Louis sailed on her third voyage on her schedule time, June 26.

The Strangest Insect in the World.

The aweto, as the Maoris or natives of New Zealand call it, or Hipialis virescens, as naturalists term it, is found in New Zealand, and is a vegetable caterpillar of from three to four inches in length, and, so far, science has not been able to say whether it is a vegetable or an insect. It is always found at the foot of large myrtle trees that have beautiful red flowers on their stems, and a beautiful creeping clematis as white as the snow. The Maoris call this tree by the name of rata. The aweto buries itself among the roots of the rata, a few inches below the ground, and there lives until it is full grown, when it undergoes a most wonderful change. The spore of a vegetable fungus, termed by naturalists Sophœria robertsii, fastens itself to the neck of the caterpillar, just between the head and the first ring, and then grows upward to the height of from six to eight inches. Many people assert that there is never more than one stem, but such is not the case, for some have been found with two stems, although very rarely. The stem shoots up out of the ground, above where the caterpillar is living, about two or three inches; below the earth it grows into the aweto, until it fills up every possible space within the outer skin without changing the form of the insect in the slightest way whatsoever, but simply substituting a vegetable matter for animal matter. As soon as this takes place both the plant and the caterpillar become dry and hard and die, but retain exactly the same form as when alive. The whole has a brown color, and the insect appears a wooden caterpillar, with a huge horn standing up from the back of its neck. How the caterpillar manages to propagate its species no one can tell. Usually the caterpillar becomes a chrysalis, the chrysalis changes into a moth, the moth lays eggs, and these eggs again become caterpillars, and so on without stopping. Many reasons are given why the plant shoots up from the back of the neck of the aweto. One is that the aweto has a slimy substance oozing from its neck, which, while the aweto is boring at the foot of the rata tree for its only food, catches the seed of the fungus and holds it fast there till the latter begins to grow. When it has sucked all the vegetable life out of the aweto it must naturally die, for it finds no further nourishment. The aweto is often found in large numbers.—Public Opinion.

Relative Strength of Metal and Timber.

Doctor Robert H. Thurston, in a recent article, discusses various materials in which comparisons of interest are made. At the outset he gives the following generally accepted figures: Cast iron weighs 444 pounds to the cubic foot and a 1 inch square bar will sustain a weight of 16,500 pounds; bronze, weight 525 pounds, tenacity 36,000; wrought iron, weight 480, tenacity 50,000; hard "struck" steel, weight 490, tenacity 78,000; aluminum, weight 168, tenacity 26,000. We are accustomed to think of metals being stronger than wood, and so they are, generally speaking, if only pieces of the same size be tested. But let equal weights of the two materials be compared, and it will then be found that several varieties of wood will prove stouter than ordinary steel. A bar of pine just as heavy as a bar of steel an inch square will hold up 125,000 pounds, the best ash 175,000 and some hemlock 200,000 pounds. Wood is bulky. It occupies 10 or 12 times the space of steel.

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Correspondence.

A Petrified Tree.

To the Editor of the SCIENTIFIC AMERICAN:

I thought it might be of interest to inform you of the discovery of a petrified tree 165 feet under ground, at the Stolls City mines, eight miles west of this place. The tree was found under 100 feet of lead and zinc ores and 65 feet of flint rock. The petrifaction is the best I ever saw. The grain seems to be of a fine wood. Some think it mahogany, others walnut.

H. G. VOORHIES.

Mt. Vernon, Mo., June 17, 1895.

The Uncultivated Bast Fibers of the United States.

As the indigenous or uncultivated species of plants producing bast fiber in the United States form an interesting group in the fiber series, and are the subject of constant inquiry, a report upon them by Mr. Chas. Richards Dodge has recently been published by authority of the Secretary of Agriculture and distributed by the department.

For the most part, the species considered belong to three large families of plants: the Malvaceæ, of which the cotton plant is a member; the Asclepiadaceæ, and the Leguminosæ. The malvaceous species are the most numerous and possibly the most widely distributed, their fiber possessing fair strength and comparing with jute rather than with flax and hemp, though whiter in color than the former. These Mr. Dodge would consider as jute substitutes, while the species belonging to the two other families, and which yield stronger fiber, may be termed hemp substitutes, and are therefore more valuable.

That these fibers are not employed commercially is due to several causes, one of the principal of which is the want of a satisfactory decorticating machine.

The first of the malvaceous fiber plants mentioned in the report is the swamp rose mallow (Hibiscus moschentos), one of the commonest of mallows and found in many parts of the temperate United States. Experiments with this plant date back many years, and fifteen years ago it was the subject of renewed experiment in New Jersey, the advent of new machinery for cleaning bast calling attention to the plant and placing its cultivation for fiber among the possibilities. Samples of fiber from the New Jersey experiments were considered not only as good as India jute, but as good as secondary grades of imported hemps.

The plant that furnishes the "rozelle" hemp of the Madras territories belongs to the same genus with the above. It thrives in cultivation in Florida, will grow on quite poor land, but will not stand much frost. Scientifically, it is known as Hibiscus sabdariffa.

Another malvaceous plant, which grows wild all over India, and which is common in Florida, is Urena lobata. The natives of India consider its fiber useful for manufacture into bagging and twine, and it is regarded as a tolerable substitute for hemp. The fiber is described as very fine and strong, white in color, and a meter in length.

Sida is still another genus of malvaceous plants whose bast is rich in fiber, that of S. rhombifolia being known as Queensland hemp. This species, the fiber of which is said to be easy of extraction and fine and strong, abounds in many portions of South America, and has been known as a weed throughout South Carolina for many years. Mr. Dodge's conclusions regarding the cultivation of the plant on American soil (based upon the results of limited experiment, however) lead him to think that the plant is of too slow growth and the stalks too small when grown to make it of commercial value as a fiber plant.

The cotton plant of Southern agriculture (Gossypium herbaceum) also belongs to the Malvaceæ, and it may not be generally known that its stalks contain fiber of good quality. In the collection of fibers sent to the Paris Exposition of 1889 there was a fine example of the fiber of the cotton stalk, from a plant grown in Georgia, prepared by the American Consolidated Fiber Company from a green stalk sixty days from date of planting. In the letter of transmittal it was stated that "the fiber is not only good for thread, but for a thousand other purposes. It is a splendid fiber for paper also, as it will not tear as easily as that made from wood pulp or rags."

The okra (Abelmoschus esculentus) has long been regarded as a fiber plant of value in India and other countries, though the production of its fiber has never assumed commercial importance. The plant is a native of the West Indies, but has been cultivated from early times in the Southern States for it pods, which form a useful article in the domestic economy. A few years ago okra attracted considerable attention as a possible fiber for Southern cultivation, and a large correspondence with the department resulted. As is frequently the case, however, the value of the plant and the ease of its cultivation for fiber were very much overstated, and subsequent experiments did not substantiate the claims made for the plant. "From a careful consideration of the subject in all its details, not only as relates to our own, but to other countries, and considering the weakness of the fiber compared with jute, I conclude," says Mr. Dodge, "that the cultivation of the okra plant for its fiber cannot be made a paying industry in the United States."

A very common malvaceous plant that has been cultivated experimentally in the United States, where it is everywhere common as a weed, is the Indian mallow (Abutilon avicennæ). The fiber of this plant is known in South American countries as cañapiña. Its Chinese name is ch'ing ma, and it has been exported to England under the common name of jute. It has been called also Abutilon jute, and the name American jute was once applied to it in this country. The plant produces an abundance of fiber, which is strong, glossy, and white, and the ligneous body gives more cellulose for paper stock than any other species. The fiber takes dye readily, and an advantage is claimed in this respect over Indian jute, which is antagonistic to cheap bleaching and dyeing. The fiber was once classified in value between Italian and Manila hemp, but it will not grade so high, it coming nearer to jute, as is proved by its being sold as a variety thereof.

The milkweed family, the Asclepiadaceæ, contains a large number of fiber-producing plants found in various parts of the world. The several species found in the United States all possess a fibrous bark, and bear seed pods filled with silky hairs resembling thistle down.

The most important species, viewed as a fiber plant, is Asclepias incarnata, or swamp milkweed, which abounds from Maine to Minnesota and southward to Louisiana. The fiber of this plant was well known to our Indians, who used it for making bow strings.

Samples of fiber from the plant having been submitted to the department were found to be light gray in color, much finer than hemp as usually prepared, soft and glossy, and of greater strength than the majority of bast fibers of wild growth in the United States.

Mr. Dodge thinks that the plant promises better results than any of the indigenous species above considered. If it will thrive upon waste lands where no other crops will grow, as it is said that it will, it has to that extent an advantage over hemp, considering the strength of the fiber to be fully equal to that of the latter. As to the value of the fiber in manufacture, Mr. Dodge can make no positive statements further than that samples of binding twine examined were found to be strong and good. As the fiber resembles hemp, there is little doubt that it could be employed in all uses to which the latter may be applied.

The commonest and best known species of milkweed is the Asclepias cornuti, which is found in Canada, grows over a wide section of the United States, and is well known in portions of South America and the Old World. The culture of the plant is said to be attended with little difficulty, as it generally thrives on poor soil, and, like the former species, is perennial. The only portion of it of which practical use can be made is the bast, which furnishes quite a long, glossy fiber that is strong and durable. Early authorities have given this fiber a place between flax and hemp, and it has been claimed that the yield is about equal to the latter.

Dr. Masters states that "its excellent fiber is woven into muslins, and in some parts of India is made into paper."

The fiber forms a good paper material and, doubtless, might be cultivated with profit for this purpose, if for no other.

A French firm has used the silk-like filaments of the seed vessels by mixing 20 per cent of the material with 80 per cent of wool, the fabric being called "silver cloth." The substance could not be used alone, as the cells are so smooth that they have no felting property, and therefore will not hold together and cannot be spun. They possess little strength, and can be considered only as "down," useful for no purpose but wadding or for stuffing pillows.

The family Leguminosæ contains many species of plants that yield a strong bast fiber, some of the foreign species having a known commercial value. In our own country, the single genius Sesbania of this family has attracted attention as a fiber producer. Specimens of the straight stiff canes of S. macrocarpa, or wild hemp of the Colorado River region, have been sent to the department at different times in the past twenty years. The fiber of the department museum sample is three or four feet long. The filaments as extracted are exceedingly coarse and resemble flat ribbons of fiber, uncommonly white and lustrous, and clear and smooth to a remarkable degree. Single filaments are quite strong, but when several are twisted together they lose part of their strength, a defect sometimes observed in better fibers. The fiber is sufficiently strong for small cordage for ordinary use, though too coarse for fish line or twine, as roughly prepared. Among the manufactures for which it has been claimed that it is fitted are wrapping, writing, and bond papers, twine and cordage, sacking, overall stuff, and Irish linens. The Indians of the West work it into nets and fish lines.

Having noticed the more important species of uncultivated bast fibers, it remains to mention a few forms of less importance that have been the subject of occasional inquiry or of limited experiment.

The Indian hemp (Apocynum cannabinum) has from early times been regarded as a useful fiber plant by certain tribes of our Indians, who manufacture from it bags, mats, baskets, belts, twine, fish lines, and nets. The fiber is easily separated from the stalk, and, when cleaned, is quite fine, long and tenacious. In color it is light cinnamon, though finely prepared specimens are creamy white and remarkably fine and soft. The fiber will rank with that of Asclepias for strength, and is readily obtained, since the stems are long, straight, smooth and slender. Although paper has not been made of it, it could doubtless be used for that purpose.

Urtica gracilis, one of the stinging nettles, abounding throughout the United States and Canada, possesses a good fiber in its bast. A few years ago it attracted attention in Minnesota, and an attempt was made to reduce the fiber, but the experiment was interrupted before completion and no report could be made.

Another of the nettles, Laportea canadensis, produces an average quality of fiber, samples of which were received by the department from Kansas in 1890.

Several years ago the stalks of the common burdock (Arctium lappa) were the subject of experiment in Illinois, with the object in view of producing a fiber material suitable for binding twine. The fibers in the samples submitted to the department were found to be harsh and wiry, very brittle, and to possess little strength. Fiber plants of this class have no value in the industrial economy, the fibrous material in their bast being too inferior ever to be used in manufacture where so many other better fibers are obtainable, and possibly at less cost.

Another form of fibrous material that has been employed to a certain extent in the coarsest of manufactures are the tree basts, or the fibrous inner bark of such trees as the linden and cypress. The linden trees are familiar in our public parks and gardens, where they are cultivated for adornment, though as lumber they are known as basswood. Tilia americana is the American species, while T. europœa is that of the Old World. The inner bark of the former is not utilized, as far as Mr. Dodge is aware, although the bast of the latter is much employed in Russia in the manufacture of an exceedingly coarse kind of rope for making the matted shoes worn by the peasants, and also for the manufacture of the mats which are used to a considerable extent by furniture dealers for packing. The American species was the wigobimizh, or "tying bark tree," of the Algonkin Indians, who used the bast for making ropes, thread, and coarse cloth.

The Southern cypress, Cupressus thyoides, has a very tenacious inner bark that can be readily peeled in long strips. It is not likely to come into use industrially in this country, although worthy of notice.

The wahoo (Ulmus alata) is an elm that abounds in the hummock lands of middle Georgia. The bark is very tough, and, when stripped from the tree and steeped in water for several weeks, becomes quite pliant and is said to make excellent horse collars.

Finally, the leather wood (Dirca palustris), of rich, damp woods from New Brunswick to Minnesota and Missouri and south to the Gulf, has a fibrous bark which is remarkably tough and which was used by the Indians for thongs and by country people for ropes, whence the popular names of leather wood and rope bark.

The Bicycle Hump.

"This protestation against the 'bicycle hump,'" said an old rider to me, "is very funny. As a matter of fact the man who bends over is not 'humped,' but the fellow who undertakes to sit up straight is round shouldered."

"Watch a rider coming head on," he continued, "and you will think the one leaning over the bars is 'humped,' while the other class appears straight. But when they pass and you get the rear view you find the back of the stooped fellow is straight, the bend being at the hips, the shoulders being pushed back square by the weight resting on the rider's hand, resting on top of the bar.

"The rider who tries to sit straight reaches under the grips and by pulling draws his shoulders together, cramping his chest."

I looked for myself and found the statement of my friend to be true. Look for yourselves: you will be surprised.—Bicycling World.

ON the railway bridge of the Chicago & North western Railroad in Milwaukee, Wis., a gas engine has been installed by Mr. E. C. Carter, principal assistant engineer of the road, to operate the draw bridge. It performs its work in a most satisfactory manner, and it would appear that this kind of power is particularly adapted for such work. It is cleaner than a steam engine and the fuel is obtained by simply piping city gas to the central pier of the bridge, while with a steam engine coal must be delivered on the bridge and a large amount of ash removed.

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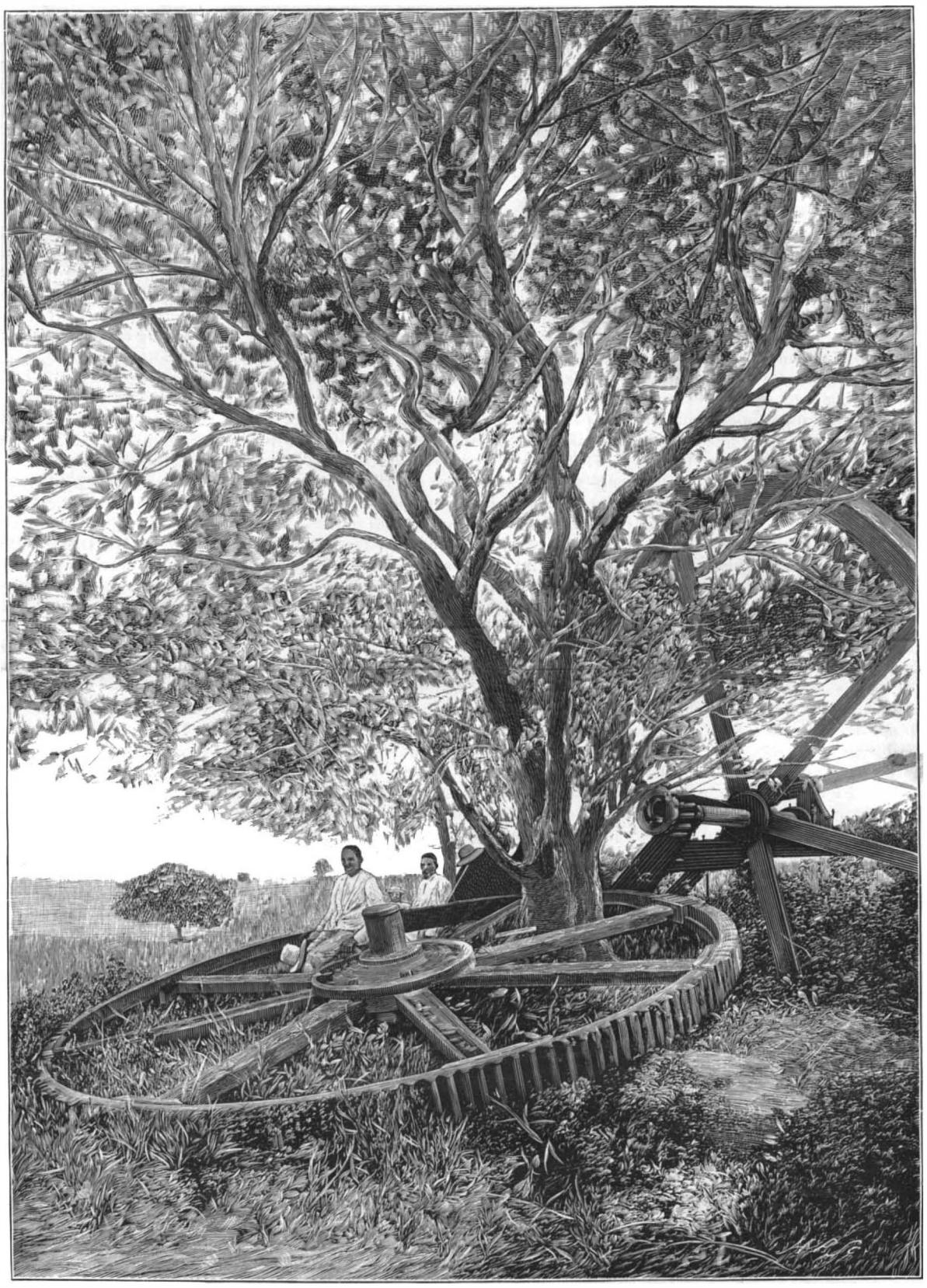
RELICS OF A CUBAN INSURRECTION.

A recent number of La Ilustracion Española y Americana contains a number of engravings of scenes in the vicinity of Manzanillo, which is in the eastern part of the island of Cuba, and the scene of the present hostilities. It was in this part of the island that the former revolution of 1868 took place. During the fighting which then occurred, the Spanish troops burned down the buildings pertaining to a large sugar estate known as the Ingenio de la Demajagua. Among the ruins left upon the ground was a large gear wheel and a fly wheel. These are shown in our engraving as they now appear after a lapse of twenty-five years, during which time a jaguey tree has sprung up between the spokes of the gear wheel and has assumed the large proportions represented in our engraving. The growth of this tree gives some idea of the Cuban flora and the rapidity with which it springs up and spreads over the ground. According to our contemporary, the present uprising of the Cubans is making extensive progress. A large portion of the eastern section of the island is already in the hands of the revolutionists, and it is doubtful whether the Spanish government will be able to bring in troops enough to overcome the patriots.



RELICS OF A CUBAN INSURRECTION.

Brine for Removing Snow and Ice from Rails.

The repeated demands by managers for a brine in place of salt resulted in President Fitch, of the Bay City, Mich., trolley road, making a series of experiments covering many months and which were at last successful in producing cheaply a method of compounding a highly concentrated clear salt liquor with specific gravity greatly in excess of water, and which is absolutely free from deposit or sediment, is no more expensive in first cost than salt, but can be applied with less trouble and expense, and is very much more economical in use, wastage being almost wholly saved. The basis of the triple chlorides, as President Fitch names the liquid, is natural salt water as pumped from his salt wells, with a mechanical and chemical treatment. It will not freeze even at 20° below zero and has an immediate action when applied, its penetrating effects being very much greater than dry salt or the brine formed from salt melting on track.

During the past winter the triple chlorides was used on several street railways with surprising and highly gratifying success, and these roads are so thoroughly convinced of its superior advantages they have abandoned salt and will use the brine exclusively in future. The method of its application will at once suggest itself to every manager. For curves, crossings and switches the brine is applied by the man whose duty it is to sweep these points, pouring the brine from a common sprinkling can with a small spout nose just as he uses water in summer.

If much is used at any special points a barrelful can be set out in any convenient basement or vacant place, as the brine will not evaporate in cold weather.

For main line tracks a small tank or keg can be set on the front platform and the brine fed to the rail by small iron pipes passing through the platform floor and reaching almost to the rails and discharging a stream from the size of a slate pencil up to any amount desirable, the flow being regulated by a cock. For very bad track and long distances, the sprinkling car used during the summer is pressed into service, the sprinkler being removed or changed so as to dischange only upon the rails. The brine has less corroding effect on iron and copper bonds than salt, and the method will readily commend itself to managers.

Electric Lighted Buoys in New York Bay.

Incandescent electric lamps on spar buoys have been experimentally used in New York Bay for several years, but an installation has now been completed which marks a considerable advance in maritime engineering and renders the entrance to New York Harbor possible for the largest vessels at any hour of the night. Gedney's Channel, which is the course taken by the transatlantic steamers, is only 1,000 feet wide, and while buoyed by day, became an impracticable course at night. It is now lighted by 10 incandescent lights of 100 candle power each, placed on the top of spar buoys on either side of the channel, forming a lighted avenue for the shipping. The lamps are mounted on 50 foot cedar buoys which are shackled to 5,000 pound mushroom anchors. The cable is constructed of a copper conductor, insulated with gutta-percha, then bedded with jute and sheathed with an armor of hard drawn copper wires. This cable carries successfully, according to the Engineering Record, a pressure of 1,000 volts alternating current under water for the distance of 6½ miles. The generating station is located about 2,000 feet back from the beach. The current for lighting the buoys is carried to the submarine cable through a lead-covered conductor laid in a creosoted subway 4 feet underground. The electric plant is in duplicate. The current is generated at 100 volts and is raised by a step-up transformer. All the high-tension lines are either underground or in cables at the bottom of the sea.

ALUMINUM felloes in bicycles are regarded by some makers as an improvement on wood.

A New Quadruple Expansion Engine.

Messrs. Hall and Treat announce, in the Sibley Journal of Engineering for April, "A New Quadruple Expansion Engine." This machine, built for regular working at 500 pounds pressure, and with its boiler tested to 1300 pounds, has now been in operation in Sibley College, at Cornell University, for many months. It was designed by the authors of the paper, built by them in the shops of the college, and has since been tested under a great variety of conditions. The design was entirely original, although, of course, embodying the principles taught them in their college course, the one being a graduate of '93 and the other of '94, and both now candidates for advanced degrees, the one for a doctor's, the other for the master's, degree in engineering. The valve gear is new and the invention of the builders of the engine. The proportions of the multiple cylinder system are those derived by application of their text book and lecture room work; and the engine as a whole is a success. The boiler has worked well and economically up to above 600 pounds per square inch, and its waste heat is utilized in the reheating apparatus of the engine and so thoroughly as to make the temperature of the chimney very low. The steel for "running parts" was obtained from the Bethlehem Iron Company and proves to be of very fine quality. Special devices have been required, in every direction, to make the operation of the machine with such high pressure steam satisfactory and safe. Even the injector was necessarily reconstructed, as no ordinary instrument would force water into the boiler against 600 pounds pressure. The figures reported for economy are something under 10 pounds of steam per horse power per hour, and the best conditions of operation are not yet fully identified, though unquestionably corresponding closely with the preliminary computations of the designers. This figure is the lowest yet reported, even for engines of many times the size of that here described. It will require authoritative revision and corroboration; but there seems no reason to doubt its substantial accuracy, as the result of many engine trials under a great variety of conditions. If thus corroborated, it will stand as the "record of the world" for the nineteenth century. The thermodynamic consumption of this engine should be about 7 pounds of steam per horse power per hour, exclusive of all thermal wastes, and this should be approximated much more closely in engines of similar type built on a large scale. The figure attained is extraordinary, and almost incredible, for a model engine such as is described; yet it indicates a waste, by conduction and radiation, after all, of no less than twenty-five per cent of all heat sent to the machine from its boiler.—Science.

Manufacture of Great Guns.

Seven 12 inch nickel steel tube army rifles have recently been completed at the Watervliet arsenal with a variation in weight between the lightest and the heaviest of only five pounds. The guns are forty feet long and weigh approximately 115,000 pounds apiece. Each has an inner tube over which a series of hoops are shrunk for nearly the entire length. Over these is a single jacket two-thirds the length of the gun, and over this again are shrunk more hoops. Aside from this large number of parts, the guns are turned on enormous lathes during certain stages of their manufacture, and the close agreement of the entire lot is considered a remarkable feat of accurate workmanship.

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THE CASSEUIL DRAWBRIDGE.

Drawbridges were in common use in the middle ages, and even the smallest castle was provided with one. The use of them was seemingly falling into desuetude, but for some little time past the exigences of modern communications have been leading engineers to bring them to the front again. In order to render the maneuver easy, an endeavor has been made to balance the flooring in all its positions. In the bridges of the middle ages that we have just alluded to, this condition was rarely fulfilled, and, more correctly speaking, never was so absolutely.

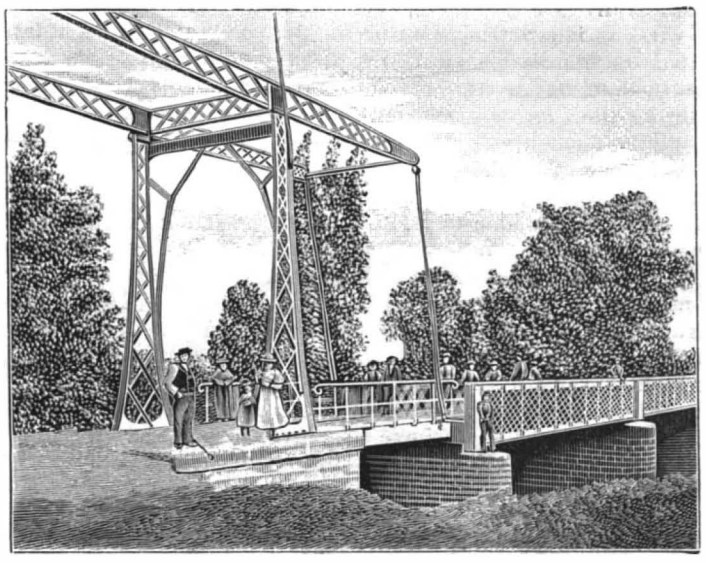


Fig. 1.—THE CASSEUIL DRAWBRIDGE CLOSED.

Poncelet, the celebrated bridge builder, occupied himself with this question. In 1810, Derche, another investigator, devised a counterpoise winding around a grooved wheel in spiral form. We may mention, further, a system due to Belidor. All these bridges were of wood. Since iron has entered into the construction of bridges, the system has become developed. In 1856, a drawbridge with a compensating balance frame was established upon the Haute Marne Canal in order to allow passage to a railway. This work is known as the Marneval drawbridge. More recently, analogous drawbridges have been constructed over the Charleroi Canal, at Brussels.

The drawbridge that we are about to describe is constructed over the lower arm of the Drop, a tributary of the Garonne, near Caudrot (Gironde). The Drop, through its division into two arms, forms a very fertile island, whose various portions belong to persons who do not inhabit it on account of its low position, which renders it very easily inundated. The upper arm of the river, which alone is navigable in ordinary times, flows into the Garonne through a lock that no longer operates when the water reaches a height of 15 feet above low water mark. The boats then take the lower arm, where they consequently navigate only very accidentally and at high water. Under such circumstances the bridge to be constructed would have had to be very high and would have required inclined approaches, whose cost would have taxed the fund disposable out of all proportion.

Mr. Clavel, government engineer, who has been at the head of the vicinal service of the Gironde for some years, and who, during his administration, has endowed the department with several remarkable works, thought that the economical and practical solution of the problem resided in the use of a drawbridge.

A project was drawn up in this direction which met with approval on every side. The work is now constructed and is operating to the entire satisfaction of all interested.

After this expose, and with a reproduction of two photographs that show the bridge open and closed (Figs. 1 and 2), a technical description does not appear to us to be necessary. Let us merely add that the bridge has three spans, and that it is the one of the right bank that is movable.

The boatmen themselves do the maneuvering when they wish to give passage to their vessel. Such maneuvering, however, is exceedingly easy, it being possible for one man to lift the flooring by acting upon a chain attached to the free extremity of the balance frame.

In this way the expenses of surveillance have been saved. Let us repeat that in many cases similar bridges will find a practical and economical application.—La Nature.

The Draught of Chimneys.

Some chimneys are made smaller at the top than at the base of the flue; others are larger at the top; and still others are of uniform size throughout, according to the fancy of those who designed them, writes W. H. Wakeman in Power and Transmission. Those who advocate the first, claim that it is the most natural way to build a chimney, and as the products of combustion ascend they become cooler, consequently contract, and do not need as much space as when they commenced their ascent. Advocates of the second, while they admit that the gases contract on cooling, call attention to the fact that as the chimney is higher, the friction of the contents increases rapidly, and so deem it advisable to enlarge area of the chimney or stack, as the draught is materially increased thereby. Those who are in favor of the third tell us that the contraction of the gases and other products of combustion counterbalances the friction, and so a flue of uniform size is correct. Each can show chimneys built according to their ideas which are doing good work, but it is a hard matter to show that the same draught could not be obtained with a chimney built according to another design, and until this is done the matter of which is the best must remain an open question.

THE ANNEALING OF ARMOR PLATES BY ELECTRICITY.

BY W. W. HANSCOM, CHIEF ELECTRICIAN, UNION IRON WORKS.

The nickel steel armor plates, as furnished the later vessels of the United States navy, are by the Harvey process hardened on the face to a depth varying from one-half inch to three-fourths inch. This face is such that it successfully resists the hardest steel drill that can be made, and as it is required in the final location of the plate to drill and tap numerous holes in it, it was necessary during the hardening process to protect the desired places by preventing the carbonizing material from coming in contact with them. The operation was not entirely successful, however, as it was found upon trial that although a number of the places were sufficiently soft to be worked, others immediately alongside were as hard as the unprotected portions. A number of attempts were made to locally anneal these hard spots by means of the oxyhydrogen blowpipe and other apparatus, the most successful being

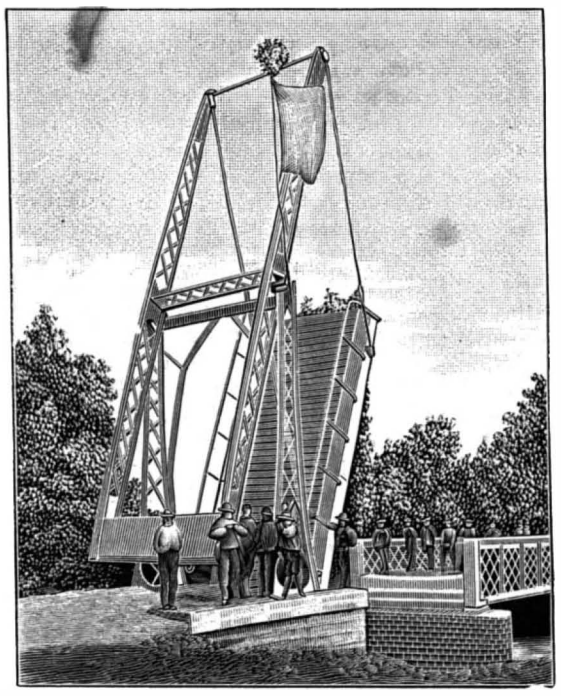
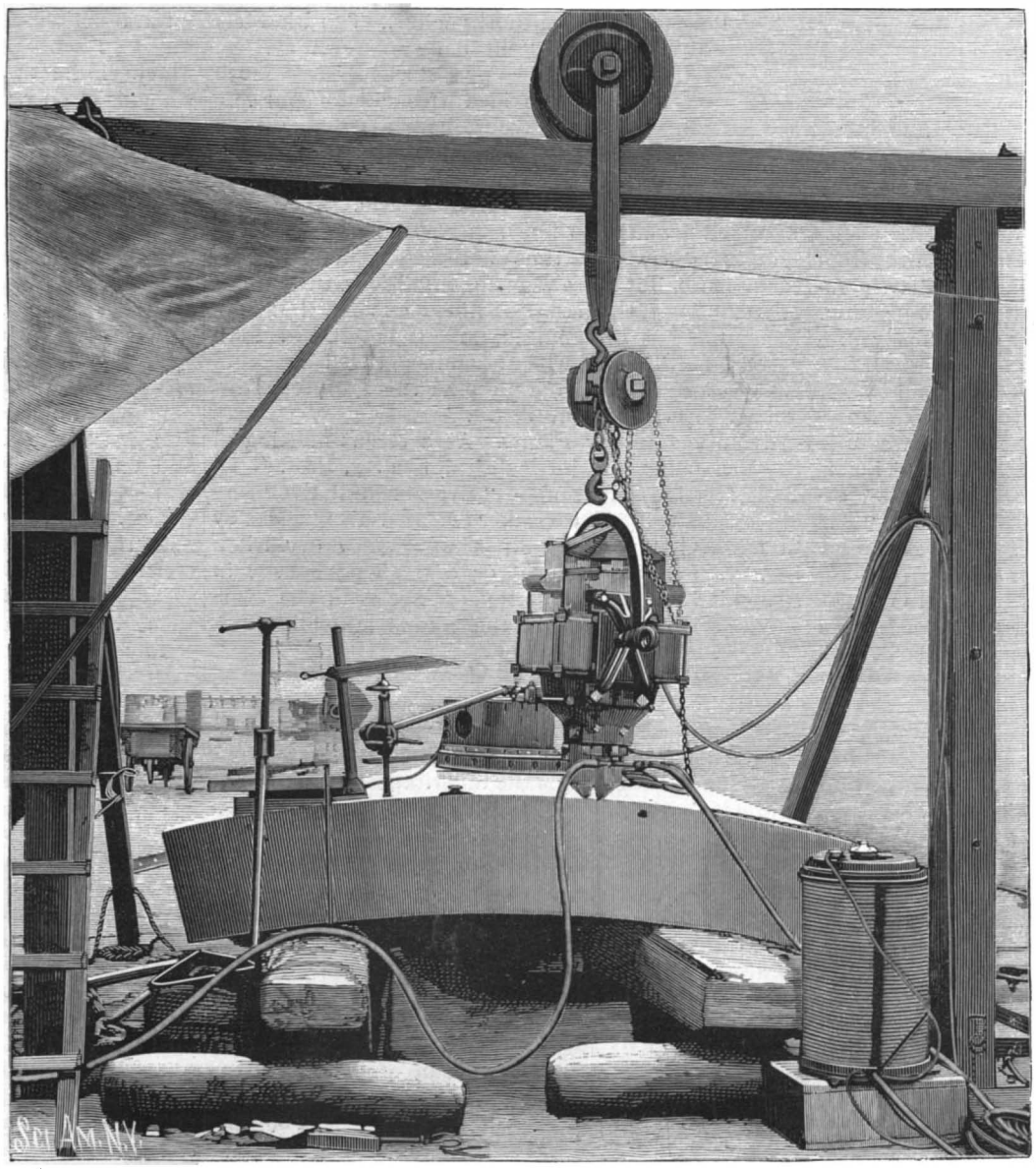


Fig. 2.—THE DRAWBRIDGE OPEN.

that offered by the Thomson Welding Company, of Lynn, Mass. It was found impossible by all other means than electricity to apply sufficient heat in a concentrated form to attain the desired results, as the large mass of metal surrounding conveyed the heat away as fast as it was supplied. One of the electric welding company's annealing equipments has recently been installed at the Union Iron Works, San Francisco, for annealing the armor plates of the battle ship Oregon, and the following is a description of the plant and its operation:

The apparatus in general consists of an alternator, with its exciter, a regulating rheostat, a transformer annealer, and the engine for driving the same. The engine develops at 450 revolutions per minute 55 horse power. The alternator and exciter are of the well known commercial type; the former, of 40 k. w. capacity, has six coils on as many pole pieces, the windings being in two series of three in multiple. The armature is of the toothed type, with six coils, connected in a multiple of three series of two. It is wound for an output of 135 amperes at 300 volts, when making 1,000 revolutions per minute. A pulley on the end of the armature shaft drives the exciter, a D type shunt wound generator of 100 volts, at 2,000 revolutions per minute. Its terminals are connected to alternator fields through the regulating rheostat, a cylindrical frame, having German silver coils cut into or out of circuit by a contact arm on top. The coils are protected from mechanical injury by the wire gauze covering, which arrangement permits of a constant circulation of air.

The transformer annealer is of the shell type, and consists of an outer core of laminated iron surrounding both primary and secondary coils, the former being wound on a form, and incased inside the latter, which is a hollow copper casting made in halves to receive it, and then bolted together, after which the remaining space is filled with oil for insulation and as an assistance in conducting away the heat generated in the primary. The secondary coil has but a single turn, U-shaped, to the ends of which are bolted various shaped copper



THE ANNEALING OF ARMOR PLATES BY ELECTRICITY.

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contact pieces, which are hollowed and connected to a water circulation, thus preventing the heat of annealing from reaching the coils. The yoke from which the transformer is suspended by two trunnions, as well as the afore-mentioned contact pieces, permit of the transformer being swung into any desired angle, and brought against any part of plates already located.

In the operation of annealing, the contact pieces are brought up against the brightened surface of the plate and wedged into position, straddling the spot to be annealed, after the regular rheostat has been adjusted to a point reducing the primary current to a minimum. The distance between the contact pieces for a hole ⅞ of an inch in diameter is 1¾ inches. When the contact is established between contact pieces and the plate, a slight humming noise notifies the operator, and the primary current is gradually raised to its maximum. A bright red spot then appears under each contact piece. The intense local heat at these spots causes the plate to expand outwardly in the direction of least resistance, forming slight mounds, from which circles of a gradually changing color slowly approach the center. The primary is kept up till the plate has become sufficiently heated to char or even ignite a pine stick held against it, and is then gradually decreased, till it has again reached the minimum.

The first or heating period requires about three minutes, duing which the secondary current has reached from 3,500 to 6,000 amperes at four volts. The second or cooling period requires from ten to twelve minutes, in order to permit the sudden chilling of the spot due to the surrounding mass of metal, and to insure a perfect anneal. The plate at the spot of annealing presents a dark blue color, elliptical in shape, with a major axis of 4 inches and a minor axis of 2½ inches, and is very readily drilled and tapped.

The cut shows the annealer at work on a 17 inch plate for the Oregon's 13 inch barbette. A portable drill press driven by a direct current motor is shown in the background, ready to drill the holes as fast as the plate is annealed. The regulating rheostat is shown in the lower right hand corner. Four wires are led from alternator and exciter to a convenient spot, and connected to annealer and regulating rheostat through a flexible four-wire cable.

In conclusion, the writer wishes to tender his thanks to Mr. W. S. Garton, of the Thomson Welding Company, for information in regard to the apparatus, and also to Mr. Ratto, photographer of the Union Iron Works, for the photograph herewith presented.—Pacific Electrician.

Natural History Notes.

Singular Case of Commensalism.—A singular case of commensalism, says the Revue Encyclopedique, has just been made known by Mr. Gadeau de Kerville. It concerns the young of the marine fishes called false mackerel, which are almost always found in company with the large medusæ known as rhizostomes. These young fishes swim parallel with the long axis of the jelly fish and in the same direction as the latter. They remain above, beneath, and behind the animal, but never advance beyond its umbel. It frequently happens that some of them introduce themselves into the cavities of the jelly fish, and are then visible from the exterior, owing to the transparency of the host. Sometimes the school of fishes wanders a few yards away from the medusa, but, at the least alarm, immediately returns with great rapidity to occupy its former position. It is evident that the medusa very efficaciously protects the young fishes by means of its innumerable stinging capsules. This is demonstrated by the fact that when the fishes become larger they no longer protect themselves by accompanying the medusæ.

Preserving Sea Weeds.—The following recipe is recommended by Dr. J. P. Lotsy for preserving examples of Florideæ for microscopic examination: "The specimen is first laid in a 1 per cent solution of chrome alum in sea water and kept there for a period varying from one to twenty-four hours, according to the size and texture of the species. The chrome alum is then completely washed out and the specimen placed in a mixture of 5 ccm. of 96 per cent alcohol in 100 ccm. of water and vigorously stirred. The amount of alcohol is then increased by increments of 5 ccm. every quarter of an hour until it amounts to 50 ccm. The specimen is then removed and placed in a mixture of 25 per cent alcohol in distilled water, and the quantity of alcohol again increased in the same way, till it amounts to 50 ccm. alcohol to 100 ccm. of water. The same process is again repeated with 50, 60, 70, 80, and 90 per cent solutions of alcohol in distilled water; the specimen being finally preserved in the last."

Resistance of Vertebrates to Thirst.—The camel is the animal that is oftenest mentioned as an example of one in which thirst is the longest endured. But Mr. S. M. Gorman, of Cambridge, Mass., writes to Nature that more striking cases of prolonged endurance are found in a number of small rodents that inhabit the arid plains in the vicinity of the Rocky Mountains. These animals live for weeks and months without meeting with a single drop of water. The sand is torrid, the entire vegetation is burned up, and yet they resist. This is not the result of observation solely, for direct experiment has been made. Some common mice were put apart on the first of last October in cages in which they received nothing but perfectly dry food, such as Indian corn and grass seeds. On the seventeenth of January they were in perfect health and seemed as if they would continue thus for a long time, although they had not received a single drop of water or of any other liquid in the interim.

Activity of Animals.—In a recent number of Science Mr. Stewart gives the results of some interesting experiments upon the activity of animals that were made upon rats, mice, and squirrels inclosed in circular cages so arranged that every motion of the occupant caused the cage to revolve. An automatic apparatus permitted of registering the motions of the cage and of consequently ascertaining the periods of rest and activity of the animals. Rats and mice divide their time into twelve hours of rest and twelve of intermittent work during the night. During the period of work, the intervals of activity rarely exceed one hour, and are separated by intervals of rest of a nearly equal duration. In winter the squirrel works almost continuously from twenty minutes to two hours in the morning, and sometimes a little in the evening also, but during the balance of the time it remains at rest.

The food has a marked influence upon the daily activity. As a general thing, the richer this is in protein, the greater is the activity. Fatty substances have a contrary effect. They reduce the activity of mice from six to eight hours to a few minutes of work a day. In order to ascertain the influence of alcohol there was given to four rats fed upon dry grain some of this liquid at proofs varying from 5 to 60 per cent, instead of water. This treatment, kept up for fifty days, showed no uniform effect of the alcohol.

All the animals experimented with did more work when the barometric pressure was high.

Animals in Sterilized Air.—By keeping animals in a specially devised apparatus designed to supply them with air in an absolutely sterilized condition and also feeding them with food as far as possible free from bacteria, Dr. J. Kijanozin, of the University of Kieff, has been able to ascertain that there was a remarkable decrease in their assimilation of nitrogenous matter. The reason suggested is that micro-organisms, when present, aid in the decomposition and peptonizing of the nitrogenous matter in the intestine, and it is thought that were the removal of all the micro-organisms from the intestine possible, the decrease in the assimilation of nitrogen would be still greater. The animals also lost weight more quickly than under normal conditions, and excreted more nitrogen and carbon dioxide. In a number of cases the animals died a few minutes, hours or days after the beginning of the experiment, and as yet it has not been possible to assign any cause for this result.

The Poison of the Ornithorhynchus.—The hind feet of the ornithorhynchus, "the mole with webbed feet and the bill of a duck" that puzzed zoologists so much for a long time, are provided with a solid spur connected with a gland. Have we here a poison gland? From some apparently trustworthy accounts that have reached him, Mr. Stewart thinks we have. This gland is at least venomous at a certain season. A dog was wounded by one of these spurs three times, and the symptoms the first time were those of pain and somnolence, but there were no convulsions, titubations or trembling. Upon the two other occasions, the symptoms were less pronounced, and even null, thus indicating habituation. The poison has proved mortal to the dog in four cases, but in man the symptoms disappear without causing death.

Evolution among Plants.—At a recent meeting of the Massachusetts Horticultural Society, Prof. L. H. Bailey read a paper upon "Experimental Evolution among Plants." The speaker prefaced his remarks by saying that all thoughtful persons are now evolutionists, whether they know it or not. They believe in some kind of a transformation of species in the same way that they believe in the gradual unfolding and growth of human institutions.

Prof. Bailey then proceeded to consider the question: Do new species originate now? The notion that a species, to be such, must have originated in Nature's garden and not in man's has been left over to us from the last generation—it is the inheritance of an acquired character. Ray appears to have been the first to use the word species in its technical natural history sense, and the matter of origin was an important factor in his conception of what a species is. Linnæus said: "We reckon as many species as there were forms created in the beginning." Darwin elaborated the new conception that a species is simply a congregation of individuals that are more like each other than they are like any other congregation, and declared that one new variety raised by man will be a more important and interesting subject for study than any more species added to the infinitude of already recorded ones. The old naturalists threw the origin of species back beyond known causes, while Darwin endeavored to discover their origin; and it is significant that he set out without giving any definition of what a species is. It is important, when we demand that a new species be created as a proof of evolution, that we are ourselves open to conviction that the thing can be done. The fact is that the practice of systematic or descriptive botany is at variance with the teachings of evolution. Every naturalist now knows that Nature does not set out to make species. She makes a multitude of forms which we, merely for purposes of existing methods of botanical description and nomenclature, call species.

The speaker then proceeded to show that there has been as wide a variation in very many garden plants as there is between accepted botanical species of the same genus.

Species making forever enforces the idea of the distinctness and immutability of organic forms, but study of organisms themselves forever enforces an opposite conception. The intermediate and variable forms are perplexities to one who attempts to describe species as so many entities which have distinct and personal attributes. So the garden has always been the bugbear of the botanist. Even the lamented Asa Gray declared that the modern garden roses are "too much mixed by crossing and changed by variation to be subjects of botanical study." He meant to say that the roses are too much modified to allow of species making. The despair of systematic botanists is the proof of evolution.

If species are not original entities in nature, then it is useless to quarrel over the origination of them by experiment. All we want to know, as a proof of evolution, is whether plants and animals can become profoundly modified under different conditions, and if these modifications tend to persist. Everyone interested knows, as a matter of common observation and practice, that this is true of plants. He knows that varieties with the most marked features are passing before him like a moving panorama. He knows that nearly every plant which has been long cultivated has become so profoundly and irrevocably modified that people are disputing as to what wild species it came from. Consider that we cannot certainly identify the original species of the apple, peach, plum, cherry, orange, lemon, wine grape, sweet potato, Indian corn, melon, bean, pumpkin, wheat, chrysanthemum, and nearly or quite a hundred other common cultivated plants. It is immaterial whether they are called species or varieties. They are new forms. Here is the experiment to prove that evolution is true, worked out upon a scale and with a definiteness of detail which the boldest experimenter could not hope to attain were he to live a thousand years. The horticulturist is the only man in the world whose distinct business and profession is evolution. He of all other men has the experimental proof that species come and go.

Formation of Secretions in Plants.—Dr. A. Tschirch announces, in the Botanisches Centralblatt, the remarkable discovery that in all normal cases which he has been able to examine the formation of a secretion it is a function, not of the protoplasm, but of the cell wall. In schizogenous passages the secreting cells which clothe the canal contain a resinogenous layer, which is often vacuolar; in schizo-lysigenous cavities the secretion is formed in peculiar caps of cell wall belonging to the cells which inclose the space. In the oil glands of the Labiatæ, Compositæ, etc., it is produced entirely in a subcuticular layer of the cell wall, and this is the case also with the papillæ which project into the intercellular spaces of the rhizome and base of the leaves in Aspidium filix-mas, and in many, if not all, extra-floral nectaries, the secretion lifting the cuticle off from the palisade-like secreting tissue. In all stigmas examined by the author, the secretion is formed in the subcuticular mucilaginous layer of the papillæ, into which the pollen tube makes its way. Similar observations were made on the oil of oil glands and on the resin which is formed in the duramen of trunks. But, although the secretions are formed in the cell wall, they are never produced by metamorphosis of the substance of the cellulose itself. Dr. Tschirch ascribes to all resins a uniformity in chemical composition, regarding them as compounds of aromatic acids with a peculiar group of alcohols which he calls resinols.

Tests of the Maxim Gun.

The light weight, rapid fire Maxim gun, though not new, has been greatly improved of late and in its present form was given a comprehensive series of tests at Sandy Hook on June 8. The gun weighs, packed in its case together with all its extra parts and mechanism, only 45 pounds, and is easily carried on a soldier's back. When in use it stands upon a tripod. The cartridge contains 28 grains of smokeless powder and a ball of 0·303 caliber, and a rate of from 600 to 770 shots a minute is claimed at 3,200 yards effective range. A range of only 500 yards was selected for the test. The gun was taken from a man's back, assembled and fired in 58 seconds. About 500 shots a minute were fired and no attempt was made to greatly exceed this rate. In the breakdown test an essential part of the mechanism, supposed to have been broken by a shot, was taken out and replaced by a new one in 26⅘ seconds. The barrel was changed in 1 minute and 12⅘ seconds.

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THE FOUNTAIN AT GENEVA.

Our engraving represents the fountain that the municipality of Geneva has recently established at the entrance of the port of that city, at the extremity of the south jetty. This is certainly the largest fountain that exists upon the surface of the globe, since it is no less than three hundred feet in height. It may be seen from a great distance, in clear weather, detaching itself like a great white sail flapping through the effect of the wind.

The city of Geneva possesses a most complete distribution of water under pressure, the motive power for which is obtained from an artificial fall established upon the Rhone at the point of the lake. The water for domestic purposes and for the running of certain motors is raised to a height of 215 feet above the level of the lake. For the distribution of motive force, it is raised to a height of 460 feet. The reservoir is an open air one, and is situated upon the top of Bessinges, at a distance of three miles from the turbine building. A very ingenious regulator, invented by Mr. Turrettini, assures the uniformity of pressure in the piping.

The length of the first pipe line is about 40 miles, and that of the second about 60. It is with this latter that the fountain conduit is connected. The latter is set in play only on Sundays. It is sometimes set in operation also on week days, in the evening. Instead of a single jet of great height, several are then utilized that do not rise so high. Powerful electric light projectors, placed in a structure near by, brightly illuminate them with their rays of varied colors, which transform them into a luminous fountain of the most beautiful aspect.—La Nature.

Safer Than Lightning Rods.

Each day adds some new virtues to the long list of those already credited to the pneumatic. The latest of these is that the wheels of a bicycle being encircled by a band of India rubber and dry air—which is a perfect insulator — the rider is completely insulated from the earth, and, consequently, is impervious to the attacks of the electric fluid. Thus, day by day it becomes more and more a fact that life without a pneumatic tire is neither safe nor worth having. Any one who suffers from nervousness during a thunder shower has now only to go into a barn or the cellar and seat himself upon the saddle of a pneumatic-tired bicycle to be perfectly safe from lightning stroke. As the chances of a man on a bicycle being struck by lightning have been carefully calculated to be about one in a billion, the Wheel adds, there will, of course, be some pessimists who will deny that this newly discovered virtue of the pneumatic as a lightning insulator amounts to very much.

Ancient Glass.

The glass blowers of ancient Thebes are known to have been as proficient in that particular art as the most scientific craftsman of the same trade of the present day, after a lapse of forty centuries of so-called "progress." They were well acquainted with the art of staining glass, and are known to have produced that commodity in great profusion and perfection.

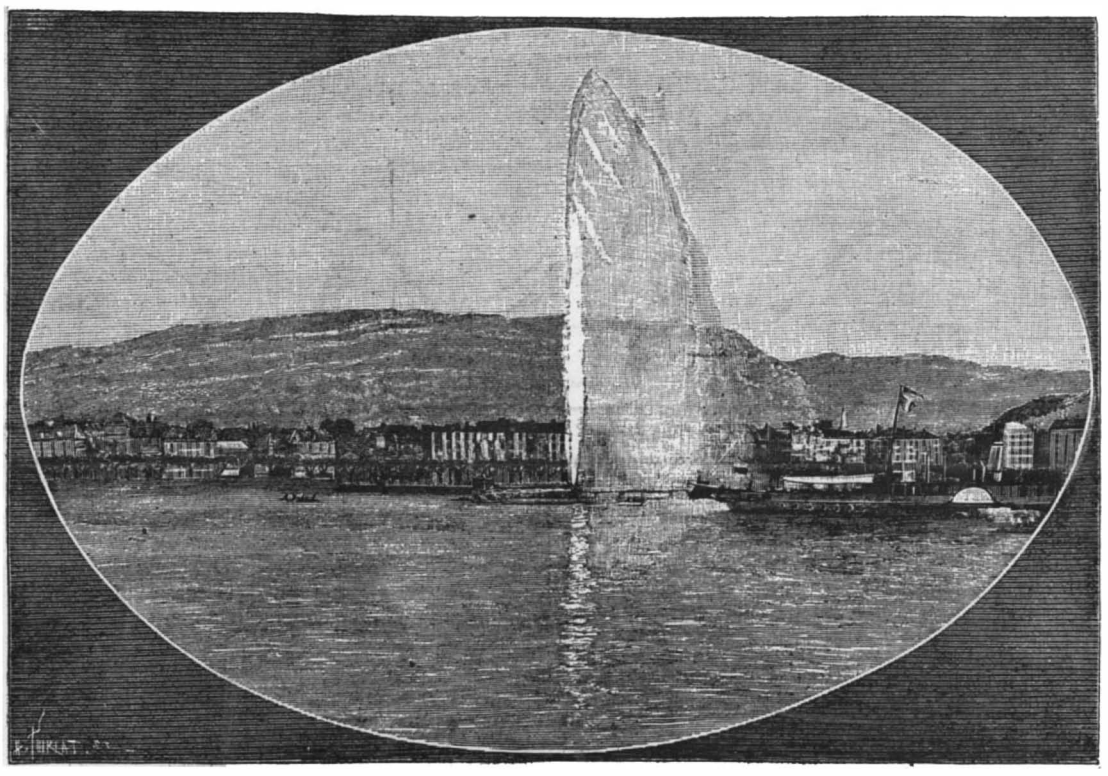
Rossellini gives an illustration of a piece of stained glass known to be 4,000 years old, which displayed artistic taste of high order, both in tint and design. In this case the color is struck through the vitrified structure, and he mentions designs struck entirely in pieces from ½ inch to ¾ inch thick, the color being perfectly incorporated with the structure of the piece, and exactly the same on both the obverse and reverse sides.

The priests of Ptah at Memphis were adepts in the glassmaker's art, and not only did they have factories for manufacturing the common crystal variety, but they had learned the vitrifying of the different colors and the imitating of precious stones to perfection. Their imitations of the amethyst and of the various other colored gems were so true to nature that even now, after they have lain in the desert sands from 2,000 to 4,000 years, it takes an expert to distinguish the genuine articles from the spurious. It has been shown that, besides being experts in glass making and glass coloring, they used the diamond in cutting and engraving glass. In the British Museum there is a beautiful piece of stained glass, with an engraved emblazonment of the monarch Thothmes III. who lived 3,400 years ago.

The New European Ship Canals.

The opening of the Corinth Canal in Greece and of the Manchester Canal in England having now been followed by the practical completion of the Baltic and North Sea Canal in Germany, a review of some of the salient features of these important works is opportune. While they possess many points of similarity, they present marked differences in the purposes they are intended to serve.

The Corinth Ship Canal affords a passage from sea to sea and is intended to meet the needs of commerce by shortening a route which is not, however, one of the highest degree of importance. Taking advantage of the fact that the Gulf of Corinth, lying in a general easterly and westerly direction, nearly separates Greece into two parts, this canal pierces the narrow Isthmus of Corinth and thus furnishes a passage from the Gulf of Corinth on the west to the Gulf of Ægina on the east. It thereby shortens the sea route from the western Mediterranean and from the Adriatic to the seaports of Eastern Greece, Turkey, Asia Minor and the Black Sea. The distance saved differs considerably in different cases, depending upon the ports of departure and destination, but is not more than 185 miles in any case. This canal is about 4 miles in length and has a minimum width of 72 feet at the bottom and 77 feet at the surface of the water, the sides rising very abruptly and being faced with masonry to a height of several feet above the water level. The minimum depth is 26 feet. The axis practically follows a straight line which passes through a low country toward either end, but in the middle portion encounters a rocky ridge, necessitating a cut about 260 feet deep in one part. The total quantity of earth and rock removed is estimated at 11,500,000 c. m. Breakwaters and artificial harbor works have been found necessary at both entrances. A high bridge, carrying the Piræus & Peloponnesus Railway, crosses near the western end. The canal is lighted at night by electricity.



THE GENEVA FOUNTAIN.

The formal opening of the Corinth Canal, which took place in August, 1893, marked the final achievement of a scheme dating back in one form or another to ancient times. The work as completed follows closely, in some parts at least, the line of a similar undertaking on which much labor was expended in the time of Nero. The modern project dates back to 1881. Work began in 1882 and was prosecuted vigorously for some years, but in 1889 ceased for a time owing to lack of funds. The enterprise was afterward taken up by a new company, the Société Hellenique du Canal de Corinthe. Work was resumed in 1890 and carried to a successful conclusion in 1893. The total cost was about $13,000,000. The lease held by the present company is to continue in force for 99 years, at the end of which period the canal is to become the property of the Greek government on the payment of $1,000,000.

Turning now to a much larger and much more costly work, the Manchester Ship Canal, special mention should be made of the fact that the main purpose served by this great artificial waterway is to give deep draught vessels direct access to the important manufacturing city of Manchester. Formerly it was necessary to depend chiefly upon the shipping facilities afforded by Liverpool, and the canal project encountered active opposition from interests identified with this port and from the railroads affected. Authority having been finally granted by Parliament, after a prolonged discussion extending over a period of several years, and a company having been formed, the work of excavation began late in the autumn of 1887 and was pushed forward with energy. Unexpected delays occurred later, owing to financial embarrassment and other causes, but all difficulties were overcome and the enterprise was carried through to completion within the space of six years. It was believed at first that four years would be sufficient and that the cost would not exceed $30,000,000. The actual outlay was about $75,000,000. Although Manchester is 50 miles from the sea, it was not necessary to carry the canal this entire distance, as the tidal estuary of the Mersey furnished an approach for about 15 miles from the sea. Throughout the remaining 35 miles existing water courses were enlarged and utilized wherever practicable, including along one part of the route an old canal of small cross section. As Manchester has an elevation of 60 feet above the sea level, an ascent of this amount was necessary, and was accomplished by a system of locks. The line of the ship canal is crossed by a number of highways and railroads, besides a smaller canal, and numerous engineering problems were encountered. In some cases fixed bridges were required; where these occur they have a minimum height above the canal of 75 feet in the clear. The minimum depth of the canal is not less than 26 feet, and the minimum width at the bottom is 120 feet. The sides are protected by masonry, where this seemed advisable, the aim being to permit a speed of about 6 knots, thus enabling a vessel to pass from the entrance up to Manchester in eight or nine hours. By the use of electric lights the canal is made navigable by night as well as by day. The preliminary opening took place early in December, 1893, and the canal was formally opened for general traffic on January 1, 1894. It may be added that Manchester is the center of a district said to be more thickly populated and to show a greater output of commercial products than any other region of like area in the civilized world. The density of population is 13 times as great as that of Belgium, which is said to have more inhabitants to the square mile than any other country of Europe. The Manchester region contributes two-thirds of the total value of British exports.

The Baltic and North Sea Canal differs from the other two, concerning which some details have just been given, in that it owes its construction primarily to political and strategic considerations rather than to the commercial advantages which will incidentally result from it. Germany has two naval yards of great importance, one at Kiel on the Baltic and the other at Wilhelmshafen on the North Sea, and in order that vessels may be able to pass promptly between them and concentrate in either sea the ship canal has been cut under the auspices of the German government. It extends from Kiel to the River Elbe, entering the latter at a point below which deep water extends to the North Sea. Commercially the canal is important in the saving of time heretofore lost in going around the northern end of Denmark and in making it possible to avoid a stormy and dangerous passage. The distance saved between ports is from 100 to 425 miles, according to their relative position. The canal is practically a sea level one, there being tidal locks at the ends, but none along the course of the waterway. It was necessary to build several bridges over the canal, but they do not interfere with navigation. The fixed bridges, of which there are two, have a height in the clear of 138 feet. The cutting was largely through a low country, following an old canal in part. At the highest point there is a ridge rising 82 feet above the sea. There are several sharp turns, though the general course is a fairly direct one. The canal is 61 miles long. The standard depth is to be 29·5 feet upon final completion in all parts. The width at the bottom is 72 feet. Work on this canal began in 1887. It was then expected that it would be necessary to excavate about 77,000,000 c. m. of material, but this estimate was too small by from 3,000,000 to 5,000,000 c. m. The total cost of the canal amounts to about $40,000,000, of which Prussia pays about one-third, the remaining part being paid by the German Empire.—Iron Age.

TWENTY-FOUR carat gold is all gold; 22 carat gold has 22 parts of gold, 1 of silver and 1 of copper; 18 carat gold has 18 parts of pure gold and 3 parts each of silver and copper in its composition; 12 carat gold is half gold, the remainder being made up of 3½ parts of silver and 8½ parts copper.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Valentine Erbach, Scranton, Pa. This improvement comprises a drawhead having at the sides noses, one below the other, with oppositely inclined upper and lower faces and parallel sides, and having vertical perforations, while a gravity link is arranged in the perforation in the upper nose. When the drawheads come together they are positively guided to coupling position and the coupling is automatically effected, and means are also provided whereby any desired number of steam and compressed air pipes may be simultaneously and automatically coupled.

CAR FENDER.—James L. Canham, South Orange, N. J. This is a device to be readily attached to or detached from the dashboard of a car, and of such construction as to present a yielding bed to any one falling on the fender. The parts are so arranged that the sagging caused by a body falling on the fender operates a trip and causes an auxiliary bed to be projected, as a further protection for a person caught in the path of the car.

Electrical.

GENERATOR.—John D. Hilliard, Jr., Bluefield, West Va. This is a compound wound alternating generator, with improved means of compounding and regulating the voltage, there being two windings on the field spools of the generator, one of which is furnished with a constant current from a separate exciter, and the other with a variable current supplied by the generator itself and varied with the variation of the load of the generator. The regulation of the voltage is quick and efficient, as there is but one magnetic field to vary.

GALVANIC BATTERY CELL.—Frank A. Glasgow, St. Louis, Mo. This is a small, easily portable cell, in which a tube or casing closed at the upper end is placed over the zinc or positive element, displacing the fluid from about the element, and protecting it from being destroyed when the cell is not in use, while the air or gas in the tube displaces the fluid when the tube is pushed down over the zinc. In the protrusion upward of the zinc from the bottom of the cell the exposed portion of the positive element stands free from support.

INSULATOR.—James M. Patterson, Springtown, Texas. For insulating and supporting telegraph and telephone wires, this inventor has devised an insulator comprising two sections of insulating material adapted to fit together and each having on its inner sides a longitudinal recess, in which blocks notched on their inner faces are to be inserted, the insulator being of a very simple and inexpensive character, and adapted to clamp the wire securely and prevent its longitudinal movement.

ALARM SIGNAL AND INDICATOR.—Jacques A. Buisson, New Orleans, La. This is a device for trolley roads, to be applied especially at crossings, curves, tunnels, and other dangerous places. Combined with the main trolley wire is a short auxiliary wire connected with the alarm and signal, and a double trolley establishes electrical connection between the main and auxiliary wires to sound an alarm and give a visible signal as the car passes along the portion of the track to be protected.

Mechanical.

PAPER MAKING MACHINE.—Thomas H. Savery, Wilmington, Del. This invention relates to the wire part of high speed Foudrinier machines, in which the water from the pulp resting upon and carried by the wires over a series of table rolls is directed and caused to flow into save-all boxes, and provides table rolls adapted to support the wire, with deflectors interposed between the rolls and extending downward to the plane or level of the lower surfaces of the rolls, to prevent the water being thrown from one roll to the adjacent roll.

Miscellaneous.

STENOGRAPHIC MACHINE.—Joseph W. and Joseph K. Bailey, New Orleans, La. This is a machine in which the characters are formed by puncturing devices which penetrate and form a permanent record on a strip of paper, the machine being also adapted for printing as well as puncturing. The machine has a closely grouped set of horizontal and parallel bars with converging ends provided with properly shaped dies, horizontal rock shafts arranged at right angles connecting with the die bars and a series of vertical keys, there being means for connecting the keys to the rock shafts and the rock shafts to the die bars.

TIRE TIGHTENER.—Jasper N. Jennings, Portland, Oregon. According to this improvement, in a foot section adapted to fit on the wheel hub is journaled a screw carrying a laterally extending lifting arm, a nut threaded on the screw having a laterally extending arm on which a hook is adjustably held. The device is strong, cheap, and simple, and may be readily applied to any wheel to quickly tighten the tire without removing the wheel from the axle. It also facilitates spreading the wheel for the removal of the spokes if necessary, the straightening of the tires, etc.

HORSE COLLAR FASTENER.—John H. Emerson, St. Joseph, Mo. This invention relates to fastenings for separably connecting the lower abutting ends of horse collars, and provides a fastener comprising two caps to fit over and inclose the collar ends, each cap being divided horizontally and provided with securing tongs having bolt holes. The cap sections have overlapping portions to prevent slipping and locking lugs and hooks to secure them together and fasten the collar. The hame strap passes between pairs of registering lugs, and the device is easy to fasten and unfasten, holding the collar securely when in fastened position.

DISINFECTING AND PURIFYING WATER.—Carl Salzberger, Burgsteinfurt, Germany. This invention is for a process and apparatus for domestic and industrial uses, the process consisting in first mixing the water with lime paste to purify it, then charging the mixture with carbon dioxide and subjecting it to the action of an electric current to separate and set free the carbonate of lime and the carbon dioxide. The electrolytical apparatus comprises a reservoir in which is an agitating device and provided with movable slatted frames forming one of the electrodes, a metallic perforated cylinder forming the other electrode.

SEPARATING GOLD AND SILVER.—Frederick Rinder, Chicago, Ill. For separating the gold and silver in a cyanide solution this invention provides a process consisting in first subjecting the cyanide solution to the action of a solution of sulphide of iron, to separate and precipitate the silver, and then subjecting the cyanide solution, in a separate tank, to the action of chloride of zinc, to separate and precipitate the gold. The invention is an improvement on the "MacArthur-Forrest cyanide process," using but little chloride, and the process requiring but little attention and labor.

BALANCE.—Clarence N. Fenner, Paterson, N. J. In this balance the standard has a graduated segment over its upper end, and the scale beam has vertical longitudinally aligned set screws, having between their inner ends the middle knife edge engaging the upper end of the standard. The beam also has knife edges at its ends from which the pans are suspended, while a weighted inclined arm extends down from the center of gravity at the middle of the beam, there being a similar inclined pointer above the center of gravity and working over the segment. The improvement is designed for use on all classes of balances, including the most delicate and those for weighing merchandise.

ANTI-FRICTION BLOCK.—Gregory M. Mullen, Baltimore, Md. This block is especially designed for use in guiding the tiller ropes of tugs, yachts, etc., reducing the friction to permit the free and easy movement of the sheave. There are side rollers between the sheave and journal, terminating short of the end of the sheave, providing an annular cavity surrounding the journal and a flange or rib of the cap jaw entering the cavity. The sheave has its under side channeled and balls fit between the sheave and the main jaw.

BATH OR OTHER TUB.—Charles E. Marston, Dover, N. H. This invention provides means for keeping the water in the tub at a uniform temperature as long as desired, and also for quickly raising or lowering its temperature. A shower or spraying device is also provided to spray from the sides, and the tub may be utilized to heat the air surrounding the bather and maintain the required temperature in the room, the tub acting as a radiator. The tub may also be used as a laundry or kitchen tub.

CHURN POWER.—John T. Gilbert, Columbus, Ga. A turning as well as a reciprocating motion is given to the churn dasher in a very simple and effective manner by this improvement. In a vertical frame is held a shaft at whose lower end is the dasher, and on whose upper end is revolubly held a head pivotally connected with a pitman, the latter being connected with the crank arm of the drive shaft. In the shaft is a spiral groove engaged by the tip of a set screw, whereby the shaft is rotated as it is reciprocated.

CLOTHES LINE FASTENER.—Charles L. Feinberg, Brooklyn, N. Y. This is a simple device for quickly and firmly uniting the two ends of a pulley line and to facilitate taking up the slack at any time. It consists of two parts pivoted together, the outer end of one part terminating in an eye to which one end of the line is tied, while the two sections form at the other end a clamping jaw in which the line will be held by the pressure of the jaw sections.

WINDOW SHADE.—Joseph Eckert, New York City. A shade is constructed of a series of strips or sections, according to this improvement, each section being capable of movement to or from an adjoining section, providing for larger or smaller spaces for the admission of light, while the shade sections are adjustable to admit light and air without admitting the sun directly. The improvement comprises a series of independent rollers and locking devices, with a bar detachably connected to the lower parts of the shades, and all of the sections may be simultaneously manipulated.

LIQUID COOLING CAN.—Wolff F. E. Casse, Copenhagen, Denmark. For preserving and storing milk, cream and other liquids or food this inventor has devised a vessel having a jacket adapted to contain ice and prevent the water formed in the ice jacket from coming in contact with the inner wall of the jacket until nearly all the ice is melted. There are ice-holding hooks or projections in the inner wall of the vertical part of the jacket which prevent the ice from rising as the water is formed by thawing, and are thus designed to preserve the continuity of the layer of ice on the inner wall of the jacket.

ILLUMINATED COLUMN.—Charles Sieburg, New York City. In fixtures for offices, bars, etc., this invention provides a column designed to heighten the ornamental effects. The invention comprises a base on which is a hollow shaft of translucent or transparent material with a capital of opaque material in which is held a lighting device, preferably an electric light, adapted to throw its light down into the shaft to illuminate the latter from the inside. The arrangement is such that the shaft can be taken down and cleaned, and ready access to the lamp is provided for.

BICYCLE TROUSERS.—Henry J. Roschi, New York City. These are garments adapted to give efficient support to the abdomen and other parts of the body, and they have elastic gores at the waistband and novel leg attachments adapted to relieve strains and obviate any danger of rupture, while insuring a comfortable adjustment and good fit of the garment.

GAME APPARATUS.—Charles H. Buxton, Neenah, Wis. A game similar to that of base ball may, according to this invention, be played by a simple and inexpensive device with which runs may be scored, the player put out, the circuit of the bases made, etc., in manner simulating that of a regular game. The field is inclosed in a box and at the four corners of the diamond are holes representing the bases, there being also slots to represent "fouls" and holes to represent "outs," and the game being played by the movement of a ball over the board which constitutes the field.

Designs.

CANDLESTICK.—William Varney, New York City. This design comprises a representation of a flower and a cup somewhat concealed among the leaves, together with a foliage support in which are stems, leaves and buds.

ROLLING HOOP.—Francis C. Bates, Newport, Vt. In this hoop is a central star-like figure consisting of a circular disk having a double series of radial projections, and between the central figure and the hoop are connecting cords.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

STEAM AND THE MARINE STEAM ENGINE. By John Yeo. London and New York: Macmillan & Company. 1894. Pp. xiv, 196. Price $2.50. No index.

Naval steam engineering is a profession which is acquiring year by year a greater importance. The possibility of economy and the importance of achieving it on ship board have brought about some of the most perfect types of boilers and steam plants which have been devised. This is another way of saying that the naval steam engineer stands justly at the head of his profession, having to design the most perfect power apparatus and to use it properly. The coal consumption is nowhere more closely watched than on a steam vessel, and in the present days of record trips the chief engineer is as important an officer as the captain. Although we regret the absence of an index, a very full table of contents, to a certain extent, takes its place.

REPORT OF THE BOARD OF GENERAL MANAGERS OF THE EXHIBIT OF THE STATE OF NEW YORK AT THE WORLD'S COLUMBIAN EXPOSITION. Transmitted to the Legislature April 18, 1894. Albany: James R. Lyon, State Printer. 1894. Pp. 647.

We will not attempt to describe this large volume. It is enough to say that it is an exhaustive synopsis of what New York State proper showed at Chicago, with numerous illustrations of the exhibits. We notice, among others, very satisfactory plates of the work shown by the Teachers' College, recently illustrated in our columns, but as every third or fourth page has a full plate, it will be found a perfect album of the exhibits and of many that will have a homelike and familiar aspect to the New Yorker. We doubt if any State can produce a much more creditable report upon its exhibits. The large size of the plates makes them tend to be satisfactory, and we think that teachers and other professional workers will find the volume one of great value. Numerous portraits are given of the members of the Commission, while general views of the fair proper are not lacking.

ELEMENTS OF MINERALOGY, CRYSTALLOGRAPHY AND BLOWPIPE ANALYSIS, FROM A PRACTICAL STANDPOINT. By Alfred J. Moses and Charles Lathrop Parsons. New York: D. Van Nostrand Company. 1895. Pp. vii, 342. Price $2.

The joint authorship of this volume gives it value, as it involves the views of two somewhat separated institutions. The book is rather more a work on crystallography and the identification of minerals than a blowpipe manual of the usual kind, the application of the blowpipe to mineral identification being closely followed in it. The work is qualitative in the sense that quantitative analysis is not given. The liberal illustrations and thoroughly practical treatment make it quite an attractive addition to the literature of the science.

THE DISEASES OF PERSONALITY. By Th. Ribot. Chicago: The Open Court Publishing Company. 1895. Pp. 163. 16mo. Paper 25 cents, cloth 75 cents.

An authorized translation of the work of M. Ribot, professor of comparative and experimental psychology in the College of France. He is also the author of "The Psychology of Attention" and "Diseases of the Will." The present work treats of organic disorders, affective disorders, disorders of the intellect, dissolution of personality, zoological individuality, etc.

CATECHISME D'ELECTRICITE PRATIQUE. By Ernest Saint-Edme. Paris: Bernard Tignol. Pp. 128. 16mo, 73 illustrations.

Under the attractive catechism or question and answer form the author has attempted to treat the whole subject of electricity in 128 pages. The illustrations are poor and do not show the later forms of apparatus. The work is undated and has no index.

THE MECHANICAL ENGINEER'S POCKET BOOK. A reference book of rules, tables, data, and formulæ, for the use of engineers, mechanics, and students. By William Kent, A.M., M.E. New York: John Wiley & Sons. 1895. Pocketbook, full gilt, flaps. Pp. 1087. Illustrations, tables, etc. Price $5.

More than twenty years ago the author began to follow the advice given by Nystrom: "Every engineer should make his own pocketbook, as he proceeds in study and practice, to suit his particular business." The results of Mr. Kent's judicious gathering of engineering facts and figures are found in the present admirable collection of rules, tables, and out of the way information. The scope of the work is different from that of Trautwine and Haswell and it would be a valuable acquisition to all who possess these important works. Much attention has been paid to the abstracting of data of experiments from recent literature. The section relating to ice machines is particularly valuable, as the literature on this subject is limited. The electrical tables are interesting, and the section devoted to fuels is also noteworthy. The greatest merit of the book consists in its furnishing information which would require long search in the files of technical journals and the proceedings of professional societies. Even such subjects as jet propulsion are adequately treated. Access to the stores of information is rendered easy by an excellent index.

PRACTICAL DIRECTIONS FOR ELECTRIC GAS LIGHTING AND BELL FITTING FOR AMATEURS. By Edward Trevert. Lynn, Mass.: The Bubier Publishing Company. 1895. Pp. 64. 16mo, 18 illustrations. Paper 25 cents.

This inexpensive little work contains an excellent series of diagrams of connections which will be appreciated by all electrical bell fitters.

HISTORY OF EDUCATION IN MARYLAND. By Bernard C. Steiner, Ph.D. Contributions to American educational history, No. 19. Washington: Published by the United States Bureau of Education. 1895. Pp. 331. 8vo, illustrated.

The present work forms one of the interesting monographs on the history of education by States. The series is edited by Dr. Herbert B. Adams, professor of American and institutional history in the Johns Hopkins University. Maryland has not obtained wide renown until recent years for her higher institutions of learning, and yet the number and importance of them has been too great to justify such neglect as they have received. The present work gives a succinct account of education in colonial Maryland, primary and secondary education, the first university of Maryland, etc. The Johns Hopkins University comes in for a fair share of attention. The value of the work would be enhanced by an index.

THE PHONOGRAPHIC DICTIONARY AND PHRASE BOOK. By Benn Pitman and Jerome B. Howard. Cincinnati: The Phonographic Institute Company. 1894. Pp. 48. 16mo, pamphlet. Price 10 cents for the first part; no other parts will be sold separately. The completed work will cost $2.50 in cloth.

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JUNE, 1895.—(No. 116.)

TABLE OF CONTENTS.

1. A cottage at Bronxwood Park, Williamsbridge, N. Y., recently erected for Dr. Geo. P. Shirmer, at a cost of about $2,500. Perspective elevation and floor plans. A pleasing design. A. F. Leicht, Esq., architect, New York City.
2. An elegant plate in colors showing a cottage at Bronxwood Park, Williamsbridge, N. Y., recently erected at a cost of $2,200. Perspective view and floor plans. Mr. A. F. Leicht, architect, New York City. A neat design.
3. A cottage at Flatbush, L. I., recently erected for W. K. Clarkson, Esq., at a cost of $5,000. Perspective elevation and floor plans. Mr. Christopher Myers, architect, New York City. A picturesque design.
4. A modern cottage at Bedford Park, New York City, recently erected at a cost of $3,000. Perspective elevation and floor plans. A picturesque design. Mr. Edgar K. Bourne, architect, New York City.
5. The Bedford Park Congregational Church. Two perspective elevations and floor and basement plans. Cost complete, $7,000. Mr. Edgar K. Bourne, architect, New York City.
6. A Colonial cottage recently erected at New Dorp. S. I., at a cost of $3,675, complete. Perspective elevation and floor plans. Messrs. Child & De Goll, architects, New York City. An attractive design.
7. A residence at Germantown, Pa. Two perspective elevations and floor plans. Cost complete, about $10,500. Messrs. Child & De Goll, architects, New York City.
8. The New Theater, San Luis de Potosi, Mexico. Architect, Don Jose Noriega.
9. Design for a window decoration.
10. The residence of E. P. Sandford, Esq., at Montclair, N. J. Two perspective elevations and floor plans. An elegant design. Architect and builder, Mr. E. P. Sandford, Montclair, N. J.
11. A cottage in the English half-timbered style recently erected for F. E. Kirby, Esq., at Glen Ridge, N. J. Perspective view and floor plans. E. Rollin Tilton, designer, New York City.
12. Miscellaneous contents: The Hanging Gardens of Babylon.—Perspective drawings.—Concrete roofs.—Points of support.—Architects' estimates.—An improved hot water heater, illustrated.—A new invention for raising water, illustrated.—Improved paving.—The Bommer spring hinge, illustrated.—A mixing regulator for gas machines, illustrated.—Adjustable sliding door track and hanger, illustrated.—Woodworker's improved vise, illustrated.—African mahogany.—A new steam and hot water heater, illustrated.—Powers' improved automatic chimney top, illustrated.—Improved wood working machinery, illustrated.

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References to former articles or answers should give date of paper and page or number of question.

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(6563) J. C. B. says: 1. Will you be kind enough to give formula to make liquid glue similar to the Le Page glue? A. We have not the Le Page formula. A liquid glue possessing great resisting power, recommended for wood and iron, is prepared, according to Hesz, as follows: Clear gelatine, 100 parts; cabinet makers' glue, 100 parts; alcohol, 25 parts; alum, 2 parts; the whole mixed with 200 parts of 20 per cent acetic acid, and heated on a water bath for six hours. An ordinary liquid glue, also well adapted for wood and iron, is made by boiling together for several hours 100 parts glue, 260 parts water, and 16 parts nitric acid. 2. Also simple and effective way to remove warts on face? A. Castor oil constantly applied from 2 to 4 or 6 weeks, each day, that is, once a day; it has not failed in my hands, says a writer in the Therapeutic Gazette, in any case of any size or long standing. The time it takes may try the patience of the user, but, if faithfully used, they will get their reward in the removal of the wart without leaving any scar.

(6564) J. S. S.: It is impossible to obtain Morse signals with a Thomson siphon recorder. Any book on telegraphy will give you a description of the Atlantic cable.

(6565) G. G. M. writes: 1. I have made my own zinc sticks, and would like to know the easiest and best way to amalgamate them? A. Dip them in dilute sulphuric acid, then sprinkle on a little mercury and rub it around, or dip the rods in a solution of nitrate of mercury. 2. Would like to know the ratio of the different ingredients for the solution of a bichromate of potash battery? A. To a saturated solution of bichromate of potash, slowly add one-fifth its bulk of sulphuric acid. 3. I have some electric light carbon sticks (without copper) ½ inch in diameter and 7 inches long. How many carbon sticks to zinc surface is necessary in a bisulphate of mercury battery; and give the solution for this battery. How many carbon sticks in a bichromate of potash? A. Six or 8 carbon rods. Make a thick paste of bisulphate of mercury in water. 4. Give the best and easiest way of connecting the carbon sticks without soldering? A. Cast lead caps on the carbons. 5. In the answer to query No. 6203, September 1, 1894, must the solution, when placed in the jar, be a thin paste or have some water added? A. Thin paste. 6. What is the best battery for induction coils? A. Grenet. 7. Does it matter whether or not the secondary is wound in opposite direction to the primary? A. No. 8. Give ratio of quantity of primary to secondary for any number of wire, especially for Nos. 16 and 36? A. It depends on the induced current desired, 500 to 1,000 to 1. 9. What is the best material to use between primary and secondary wire in an induction coil? A. A glass tube, a rubber tube, or writing paper coated with shellac, varnish, or paraffin.

(6566) H. W. N. says: Where can I find descriptions of automobile vehicles for use on common roads? A. See the SCIENTIFIC AMERICAN for February 14, 21, 1891; May 21, 1892; February 3, March 31, April 21, June 23, 1894; January 12, February 9, March 23, April 6, May 4, June 8, 1895; and the SCIENTIFIC AMERICAN SUPPLEMENT numbers 993, 979, 912, 857, and 839.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

June 25, 1895,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid and by-products, method of and apparatus for manufacturing sulphuric, J. D. Darling.... 541,597
Acidyl compound of para-oxyphenylurethan ethers, J. F. Von Mering.... 541,489
Adjustable bit, A. T. Pearson.... 541,674
Advertising device, J. W. Snoddy.... 541,578
Alarm. See Burglar alarm.
Annealing apparatus, gold, W. D. Porter.... 541,501
Arithmetic apparatus for object lessons in, Hexewald & Rodelsperger.... 541,787
Armor plate and making same, steel, W. E. Corey 541,594
Auger, O. E. Wallner.... 541,780
Bag fastener, J. P. Dillin.... 541,729
Basket, L. Bennett.... 541,805
Basket, fruit, Elliott & Saunders.... 541,476
Bath tub, Clifford & Gavin.... 541,469
Bearing, anti-friction, W. E. Shoemaker.... 541,574
Bed bracket, G. Harris.... 541,819
Bedstead, adjustable, L. W. Bickle.... 541,586
Beer cooler trough, J. F. Duffy.... 541,690
Bevel, miter, and square, combined, A. J. Walker 541,514
Bicycle, J. A. Mundy.... 541,774
Bicycle baby seat, A. M. Southard.... 541,817
Bicycle brake, M. E. Stephenson.... 541,698
Bicycle frame, E. M. Graham.... 541,811
Bicycle lamp bracket, W. N. Beardsley.... 541,804
Bicycle support and mud guard, combined, E. J. Klinck.... 541,762
Bit. See Adjustable bit.
Blast furnace, C. Johnson.... 541,759
Block. See Building block. Fuse block.
Boat. See Folding boat.
Boiler. See Hot water boiler. Steam boiler.
Boiler cleaning device, D. O. Smith.... 541,461
Boiler heater, kitchen, A. Heller.... 541,664
Bookcase, W. M. Poindexter.... 541,678
Bookcase, folding, J. L. Roberts.... 541,504
Book clasp, F. H. Smith.... 541,576
Book support, R. H. Arnold.... 541,584
Boot or shoe, J. D. W. King.... 541,814
Bottle, A. A. Freeman.... 541,734
Bottle stopper, F. A. Maquet.... 541,623
Box. See Match box.
Box lid and support therefor, C. G. Bennett.... 541,585
Brake. See Bicycle brake.
Brake controller, electric, F. E. Herdman.... 541,545
Brake pipe coupling, Bottomly & Shaw.... 541,714
Brick glaze, B. Frey.... 541,535
Brick machine, W. E. Damon.... 541,725
Brick machine, re-press, J. A. Frey.... 541,528
Brush for applying sensitizing solutions, E. A. Osse.... 541,670
Brush, metallic, A. Hankey.... 541,537
Brush, tooth, J. W. Dennis.... 541,727
Buckle, W. Looney.... 541,488
Buckle, back band, F. C. Ruffhead.... 541,687
Buffing pad adjuster, A. E. Perry.... 541,675
Building block, J. Lee, Sr.... 541,815
Bung and bushing, J. P. Baumgartner.... 541,651
Burglar alarm, C. M. Clark.... 541,719
Burner. See Vapor burner.
Burner, C. Haffcke.... 541,533
Button shield, collar, J. A. Dunning.... 541,809
Calipers, G. Harris.... 541,749
Can filling machine, J. W. Kales.... 541,788
Can opener, G. D. Munsing.... 541,566
Car buffer, W. F. Richards.... 541,629
Car coupling, J. Harper.... 541,748
Car coupling, J. C. Parrott.... 541,496
Car fender, R. Bustin.... 541,468
Car fender, F. W. Darling.... 541,726
Car fender, I. Macowsky.... 541,770
Car fender, G. W. Mahan.... 541,771
Car fender and snow cleaner, C. A. Smith.... 541,577
Car, postal, H. H. Sessions.... 541,635
Car stop, G. H. Dippo.... 541,784
Cars, automatic life-guard for, C. M. Beebe.... 541,466
Carpet sweeper, T. H. Paris.... 541,495
Carriage, folding baby, E. H. Kellar.... 541,760
Case. See Bookcase. Show case. Spectacle case.
Castings, manufacturing steel, S. P. Hutchinson.. 541,812
Chair. See Dental chair.
Check book, A. W. Laughlin.... 541,764
Cheese, machine for manufacturing, P. Traiser, II.... 541,642
Chopper. See Cotton chopper.
Cistern forming device, J. A. Hartzell.... 541,538
Clamp. See Clothes line clamp. Rope clamp.
Clasp. See Book clasp.
Clearing and purifying apparatus, H. Peschges... 541,676
Clevis, W. S. West.... 541,517
Clip for attaching and holding in book covers counter checks, manifold copybooks, etc., E. H. Hilborn.... 541,548
Closet, W. Krebs.... 541,486
Closure, Guilleadme & Goldstein.... 541,745
Clothes line clamp, J. H. Snyder.... 541,509
Clutch and speed regulator, fluid controlled, J. Hartness.... 541,483
Clutch, friction, M. O. Reeves.... 541,571
Coin controlled apparatus, W. E. Anthes.... 541,705
Collar, horse, E. C. Phillips.... 541,627
Collar stuffing apparatus, horse, E. C. Phillips.... 541,626
Combination lock, C. F. Raymond.... 541,502
Condenser, F. M. Wheeler.... 541,781
Conveyer buckets, apparatus for filling endless, Hunt & King.... 541,614
Cooker, food, Apple & Breitwiser.... 541,706
Cooking, broiling, etc., apparatus for, C. Haffcke.. 541,534
Cooking utensil, R. Gibbons.... 541,738
Copying manifold sheet or book, carbon, E. J. Perry.... 541,498
Cotton chopper, Bledsoe & Watson.... 541,587
Cotton gin or wool burrer, G. E. U. Huckaby.... 541,753
Cotton press, G. Taylor.... 541,795
Coupling. See Brake pipe coupling. Car coupling. Hose coupling. Pipe coupling.
Crusher. See Ore crusher.
Current motor, alternating, R. Eickemeyer.... 541,604
Curtain pole, C. Zuckmaier.... 541,650
Damper regulator, S. Coats.... 541,721
Damper, stovepipe, Farnell & Hoefer.... 541,733
Daylight in dark rooms, stores, etc., device for furnishing and distributing, E. Westermayr.. 541,582
Defecator, L. A. Roussel.... 541,686
Dental chair, A. W. Browne.... 541,589
Desks, adjustable support for school, G. A. Bobrick.... 541,806
Digger. See Potato digger.
Dish cleaner, W. O. Merrill.... 541,490
Disintegrating fibrous substances, machine for, M. Young.... 541,648
Display stand, J. R. Roscoe.... 541,457
Door check, V. C. Dillmann.... 541,783
Door, flexible, H. N. G. Lugrin.... 541,768
Door, flexible, A. S. Spaulding.... 541,606
Door lock, Tower & Cole.... 541,797
Double-faced fabric, W. Weaver.... 541,645
Doubling machine stop motion, silk, H. D. Klots. 541,666
Drainage system for stables, W. F. Downey.... 541,600
Dredging, excavating, and elevating apparatus, pneumatic, G. Van Wagenen.... 541,513
Drier. See Fruit drier.
Drill. See Grain drill.
Drill milling machine, twist, M. C. Johnson.... 541,550
Drill operating device, A. M. Zimmerman.... 541,583
Drum, radiator, or evaporator, combined heating, M. R. Peters.... 541,499
Dye, black, Herzberg & Weber.... 541,750
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Electric arc light, E. A. Edwards.... 541,603
Electric conductors, protector casing for underground, J. A. Kingdon.... 541,552
Electric motor, F. E. Herdman.... 541,544
Electric motor, W. J. Still.... 541,641
Electric switch, W. P. Hancock.... 541,608
Electrical heater, thermo-controlled, L. F. Custer.... 541,724
Electrolysis of pipes underground, preventing, H. P. Brown.... 541,467
Electrolytical process and apparatus, C. T. J. Vautin.... 541,465
Elevator, J. H. Richards.... 541,683
Elevator apparatus, electric, F. B. Perkins.... 541,497
Elevator attachment, E. C. Jenkins.... 541,616
Elevator attachment, S. M. Philbrick.... 541,790
Elevators, device for removing resistances in starting electric, G. H. Whittingham.... 541,798
Engine. See Gas engine. Rotary steam engine. Steam engine.
Engraving machine table, C. C. Bruckner.... 541,523
Envelope cord fastener, M. Scougale.... 541,692
Envelope machine counter, H. B. Cooley et al.... 541,656
Envelope machines, drying chain for, H. B. Cooley et al.... 541,655
Envelope making machine, H. B. Cooley et al.... 541,470
Evaporating pan, W. S. Ballou.... 541,707
Fabric. See Double-faced fabric.
Fence stay, wire, C. E. Little.... 541,487
Fender. See Car fender.
Filter, J. W. Jarrett.... 541,755
Firearm sight, W. Lyman.... 541,558 to 541,560
Fire extinguisher automatic, N. Hicks.... 541,547
Fishing float, J. R. Kunzelman.... 541,789
Fishing line drying reel, E. C. Vom Hofe.... 541,404
Flue stopper, Z. T. Hall.... 541,746
Folding boat, J. H. Rushton.... 541,778
Friction, means for producing instantaneous, R. J. Blume.... 541,712
Fruit drier, K. S. Blanchard.... 541,652
Fur skins, machine for dehairing, C. Schirmer.... 541,690
Furnace. See Blast furnace. Roasting furnace.
Furnace, J. S. Dougherty.... 541,602
Furniture, adjustable support for, G. A. Bobrick. 541,653
Fuse block, Davis & Scott.... 541,473
Gas, apparatus for manufacture of, L. M. Heery.. 541,570
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Harvester, corn, M. Young.... 541,520
Heater. See Boiler heater. Electrical heater. Gas or oil burner heater.
Hoisting apparatus, C. W. Hunt.... 541,612, 541,613
Hook. See Check hook. Whiffletree hook.
Horse blanket, J. Hand.... 541,536
Horsemen, combination tool for, J. C. F. Schenck 541,793
Horseshoe bars, manufacture of, W. D. Young... 541,649
Horseshoe fastening, E. T. Covell.... 541,524
Hose coupling, W. Curlett.... 541,596
Hose nozzle, C. Callahan.... 541,716
Hot water boiler, J. Galt.... 541,737
Injector, S. L. Kneass.... 541,620
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Lamps, carbon electrode for electric arc, S. Heilmann.... 541,541
Lamps, gas generating burner for, H. F. Smith. 541,508
Lamps, repairing incandescent, J. Mohrle.... 541,491
Lantern, gas arc, G. F. Klemm.... 541,619
Leather skiving and splitting machine, J. R. Scott.... 541,691
Light. See Electric arc light.
Lines, instrument for making broken, J. H. Knight.... 541,553
Lock. See Combination lock. Door lock. Permutation lock. Pin lock.
Lock and latch, combined, J. H. Barrett.... 541,801
Loom Jacquard mechanism, W. Weaver.... 541,644, 541,646
Loom shuttle actuating mechanism, W. Weaver. 541,581
Looms, take-up mechanism for slat and wire fabric, L. Mollart.... 541,563
Magnet, electro, F. B. Corey.... 541,471
Mail bag catcher and deliverer, T. F. Grove.... 541,482
Match box and cigar cutter, Townsend & Conway 541,702
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Mop wringer, A. M. Burnham.... 541,591
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Music, clip or clamp for holding sheets of, J. Hood.... 541,611
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Photographic printing frame, C. R. Schilling.... 541,506
Pin. See Safety pin.
Pin, P. Jeanne.... 541,813
Pin lock, J. J. Ridgway.... 541,630
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Pipe coupling, hard and soft metal, S. M. Friede.. 541,736
Planer, crank, U. Eberhardt et al.... 541,475
Plant protector, G. A. Smith.... 541,695
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Plow, T. L. Hamilton.... 541,747
Pneumatic dispatch system, C. M. Johnson.... 541,756
Pneumatic dispatch tube system, C. M. Johnson. 541,757
Pole head, carriage, E. Kipling.... 541,485
Potato digger, Z. Erickson.... 541,477
Power by alternating currents, transmission of, F. S. Hunting.... 541,615
Power transferring apparatus, C. Moyer.... 541,565
Press. See Cotton press.
Press, H. Bunker.... 541,807
Printing attachment for roll paper holders, Sullivan & Mathews.... 541,510
Propeller, screw, M. Gleason.... 541,480
Pump, W. Radley.... 541,682
Pump, piston, deep well, D. B. Stevenson.... 541,699
Pump plunger, J. S. Scott.... 541,634
Pump rod adjuster, A. C. Price.... 541,680
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Quilting machine, F. L. Palmer.... 541,625
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Railway cattle guard, R. H. Rushing.... 541,688
Railway claw bar, Trauth & White.... 541,701
Railway, conduit electric, E. Ebi.... 541,730
Railway, elevated, R. M. Fryer.... 541,662, 541,663
Railway switch, A. R. Milliken.... 541,667
Refuse from scows, apparatus for discharging, C. Gullmann.... 541,532
Rheostat for starting electric motors, automatic-working, F. E. Herdman.... 541,542 541,543
Riveting machine, cardboard, Saltzkorn & Nicolai 541,791
Riveting machines, adjustable table for, P. A. Cuenot.... 541,525
Roasting furnace, T. M. Chatard.... 541,718
Rolling shears, L. C. Thompson.... 541,463
Rolling threads on bars or rods, mechanism for, C. A. Johnson.... 541,551
Rope clamp, A. W. Lewin.... 541,557
Rotary steam engine, compound, Rinebart & Turner.... 541,684
Rubber boot or shoe, C. L. Higgins.... 541,610
Rug holder, W. H. Vandervoort.... 541,703
Saddletree, H. J. Buell.... 541,782
Safety pin, E. B. Lee.... 541,765
Safety pin, J. Schary.... 541,792
Sash balance and lock, J. M. Younger.... 541,521
Sash support and lock, W. W. Dwigans.... 541,810
Scraper, C. E. Burbank.... 541,808
Screen, G. W. Cross.... 541,595
Seam for sewed articles, H. H. Fefel.... 541,478
Seams, method of and tool for forming sheet metal, A. Langlais.... 541,621
Separator. See Grain and straw separator.
Sewing machine, J. T. Collins.... 551,722
Sewing machine, H. H. Fefel.... 541,479
Sewing machine, H. C. Peters.... 541,570
Sewing machine cabinet, T. Kundtz.... 541,555
Sewing machine cabinet, Kundtz & Kosch.... 541,554
Sewing machine drop stand, Diehl & Kraemer... 541,474
Sewing machine feeding mechanism, T. McGowan 541,567
Sewing machine guide foot, L. Muther.... 541,493
Sewing machine looper, R. G. Woodward.... 541,518
Sewing machine needle guard, L. Muther.... 541,492
Shaft aligning device, J. M. Isgrig.... 541,754
Shears. See Rolling shears.
Sheet metal articles, apparatus for forming, C. E. Richardson.... 541,456
Sheet metal working machine, U. D. Alexander.. 541,800
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Sign, advertising, J. P. Pappin.... 541,672
Signaling device, code, W. Rymer.... 541,505
Silver from its ores, process of and apparatus for extracting, J. J. Crooke.... 541,659
Sirup can for dispensing fountains, I. D. Pearson. 541,569
Snow melting machine, E. Beatty.... 541,709
Snow plow, rotary, F. D. Linton.... 541,766
Soda water dispensing apparatus, I. D. Pearson.. 541,777
Spectacle case, G. H. Lloyd.... 541,767
Spike pulling implement, Graves & Knight.... 541,531
Spring. See Wagon platform spring.
Spring wheel, I. M. Bourke.... 541,715
Stand. See Display stand.
Steam boiler, G. Sewell.... 541,637
Steam engine, F. G. Hobart.... 541,665
Steam engine, C. A. Wright.... 541,519
Steam, generating, G. G. de Villeneuve.... 541,779
Steam generator, A. Heberer.... 541,539
Stone, tile, plaster, etc., compound for making artificial, H. S. Utley.... 541,818
Stopper. See Bottle stopper. Flue stopper.
Store service apparatus, J. H. Goodfellow. 541,742 to 541,744
Stovepipe elbows, machine for making crimped, G. Cunin.... 541,472
Structure, portable, L. Nolan.... 541,776
Sugar making, L. Wulff.... 541,799
Sugar mill shredding attachment, C. Dube.... 541,786
Suppository mould, D. Genese.... 541,529
Suspenders, E. H. Benners.... 541,710
Suspenders, bracing, H. Putz.... 541,681
Switch. See Electric switch. Railway switch.
Syringe bulb, H. D. Smith.... 541,639
Tallow and meat extracts, etc., process of and apparatus for extraction of, M. J. Dempsey.... 541,599
Tongs, C. Bulmer.... 541,690
Tongue, cultivator, J. H. Gilman.... 541,607
Top, C. Barus.... 541,802
Track clearing apparatus, A. E. Trevithick.... 541,580
Trolley fender, J. P. Taylor.... 541,796
Tub. See Bath tub.
Tube corrugating machine, B. Hall.... 541,535
Tug, thill, Carr & Washer.... 541,592
Tug, thill, W. F. Sweet.... 541,700
Tuning pin, H. Muller.... 541,624
Twine holder, E. J. Powers.... 541,679
Type distributing machine, L. K. Johnson.... 541,758
Valve, cut-off, F. Markgraf.... 541,772
Valve, engine, H. R. Fay.... 541,605
Valve, motor, A. Horne.... 541,752
Valve, muffled safety, Hazlehurst & Cole.... 541,609
Vapor burner, T. A. Campion.... 541,717
Vapor burner, new process, C. Goergen.... 541,530
Vehicle seat, W. F. Downey.... 541,601
Vehicle wheel, E. D. Wassell.... 541,516
Vessels, apparatus for raising sunken, H. Schon. 541,794
Vulcanizing apparatus, Sine & Ward.... 541,694
Wagon platform spring, C. A. Weed.... 541,704
Washer. See Nut locking washer.
Washing machine, L. B. Pettit.... 541,677
Watch, stem winding and setting, Matheson & bishop.... 541,561
Water closet connection, W. H. Welsh.... 541,647
Water main equalizer, D. O'Donnell.... 541,816
Wave motor, F. O. Rusling.... 541,631
Wheel. See Spring wheel. Vehicle wheel.
Whiffletree hook, H. P. Egedal.... 541,731
Wicking, etc., machine for making covered, T. McGowan.... 541,568
Window, B. F. Betts.... 541,711
Wrench, A. Muller.... 541,668
Wrench, Nixholm & Long.... 541,494
Wringer. See Mop wringer.

DESIGNS.

Badge, W. N. Brunt.... 24,432
Bicycle seat frame, G. Harden.... 24,438
Condenser tube, T. Ledward.... 24,439
Electric controller casing, J. P. B. Fiske.... 24,427
Eyeglass nose piece, E. Hommel.... 24,434
Eye glass spring, E. B. Meyrowitz.... 24,418
Hat rack, W. M. Smith.... 24,425
Hose coupling, D. S. Robinson.... 24,429
Lamp base, J. E. Bohner.... 24,420 to 24,435
Lamp fount holder, J. E. Bohner.... 24,436
Lever, J. Macphail.... 24,440
Miter piece, E. A. Langenbach.... 24,428
Money change stand, E. A. Verbeck.... 24,422
Plateau frame, P. F. Schaefer.... 24,421
Spoon, J. W. Maillot.... 24,417
Spoon, I. B. Smith.... 24,433
Table top frame, J. E. Bohner.... 24,423, 24,424
Tobacco pipe, P. B. Jackson.... 24,419
Vending machine case, W. A. Ferree.... 24,426
Wick lamp, J. S. Donohue.... 24,437
Woven fabric, J. B. Morgan.... 24,430, 24,431

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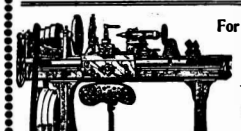

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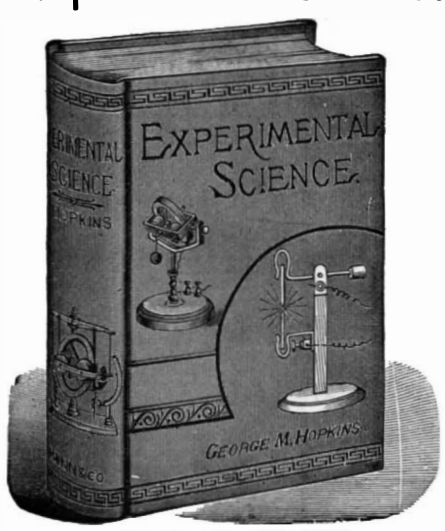

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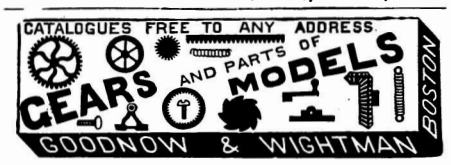

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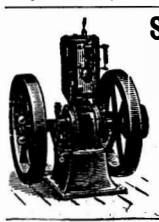

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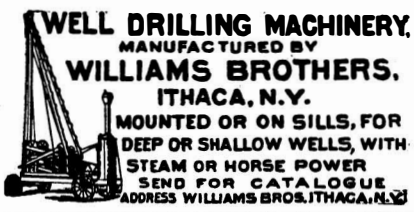

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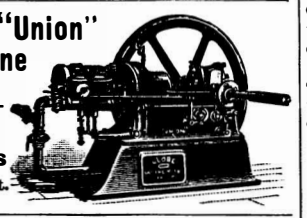

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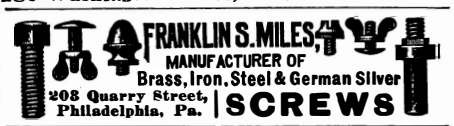

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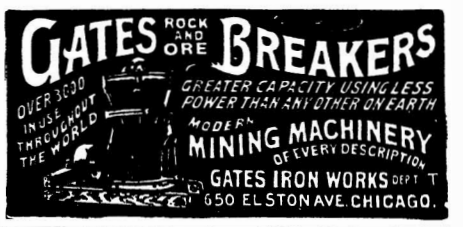

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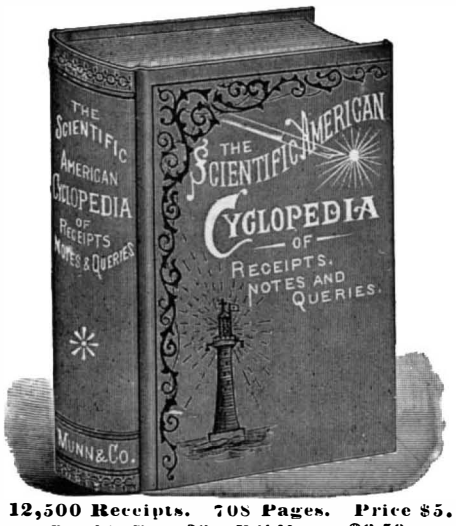

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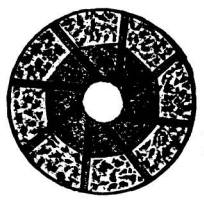

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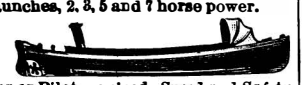

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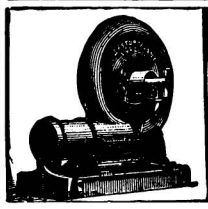

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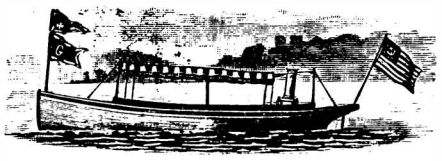

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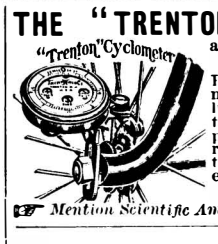

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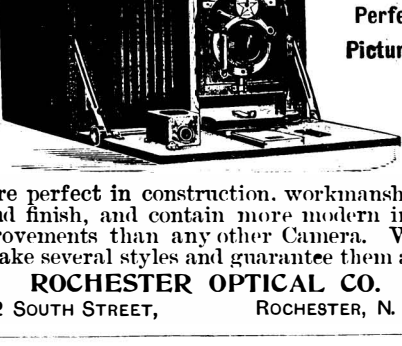

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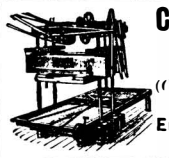

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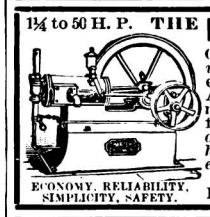

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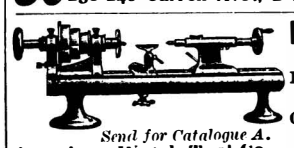

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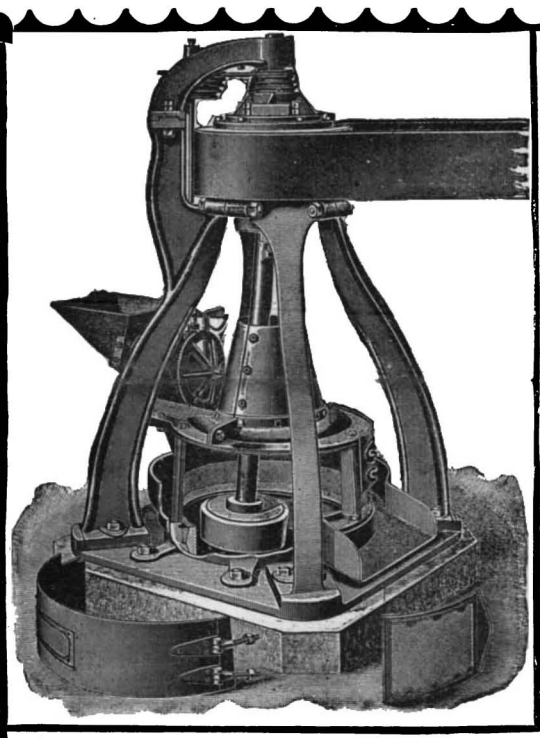

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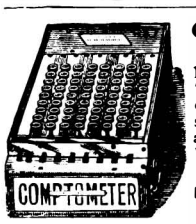

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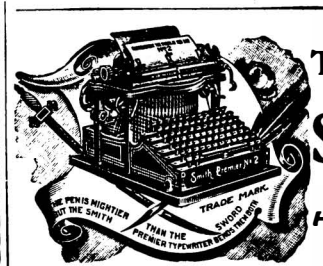

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